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Taxonomy & Inventories

An updated checklist of freshwater rotifers in Thailand: Taxonomy, diversity and distribution

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Abstract

Background

The Rotifera is the most diverse group of freshwater zooplankton. In Thailand, the research on rotifers began in 1907. Following extensive studies on rotifers in Thai water bodies, the first checklist was published in 2013, with approximately 398 species. However, the taxonomy and diversity of bdelloid rotifers, a major group of freshwater rotifers, have only been intensively studied since 2016. Therefore, we provide an updated and comprehensive checklist of freshwater rotifers in Thailand, including nomenclatural updates, species diversity, and geographical distribution.

New information

An updated checklist of rotifer fauna from inland aquatic habitats in Thailand—a high-diversity hotspot in Southeast Asia—is presented based on published records. This checklist includes revised nomenclature and updated species distributions. A total of 409 valid recorded species reflects relatively high diversity. However, estimators suggest that more species are likely to be discovered with further research. Planktonic monogononts are relatively well studied, whereas sessile monogononts and bdelloids require more

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attention. Additionally, large research gaps remain in the western and eastern regions. Each habitat type appears to support a distinct rotifer community, as indicated by generally low similarity values (Jaccard index < 0.53). Thus, habitats with unique characteristics, such as cave pools and limno-terrestrial habitats, warrant further investigation. Since the taxonomic status and species diversity have been consolidated, the geographical distribution is discussed.

Keywords

bdelloid rotifers, taxonomy, biodiversity, distribution, Oriental region

Introduction

Taxonomic studies are essential for understanding species richness, as they provide crucial information on biodiversity, global species distribution patterns, and environmental changes related to climate or global trade. The phylum Rotifera is a diverse group of zooplankton found in nearly all freshwater and semi-aquatic habitats (Wallace 2002, Segers 2008). This phylum comprises two major groups, Monogononta and Bdelloidea, whereas Seisonacea represents a small group of epizoic marine species (Segers 2007, Fontaneto et al. 2008, Segers 2008). Rotifers are highly diverse and widespread in continental aquatic environments (Fontaneto and De Smet 2015). They play a crucial role in aquatic food webs as primary consumers of phytoplankton (Allan 1976, Wallace et al. 2015) and serve as effective biological indicators for assessing water quality (Wallace et al. 2006).

Research on rotifers in Thailand began in 1907 with the work of Weber. Since then, increasing attention has been given to this group of microorganisms, particularly monogonont rotifers, resulting in a growing number of published studies. Numerous studies have focused on taxonomy, species diversity, and distribution across various habitat types (Weber 1907, De Ridder 1971, Koste 1975, Boonsom 1984, Sanoamuang et al. 1995, Sanoamuang 1996, Pholpunthin 1997, Sanoamuang and Segers 1997, Segers and Pholpunthin 1997, Pholpunthin and Chittapun 1998, Sanoamuang 1998, Chittapun et al. 1999, Sanoamuang and Savatenalinton 1999, Chittapun and Pholpunthin 2001, Sanoamuang and Savatenalinton 2001, Segers and Chittapun 2001, Chittapun et al. 2002, Chittapun et al. 2003, Segers et al. 2004, Athibai et al. 2005, Savatenalinton and Segers 2005, Jithlang and Wongrat 2006, Teeramaethee et al. 2006, Chittapun et al. 2007, Sanoamuang 2007, Chittapun et al. 2009, Segers and Savatenalinton 2010, Meksuwan et al. 2011, Athibai et al. 2013, Meksuwan et al. 2013, Sa-ardrit et al. 2017, Meksuwan et al. 2018, Jantawong and Maiphae 2020, Plangklang and Athibai 2021, Jantawong et al. 2023, Maiphae et al. 2023), while fewer studies have explored their ecology such as the recovery of rotifers from resting eggs (Chittapun et al. 2005, Athibai and Sanoamuang 2008, Chittapun 2011).

Following extensive studies on rotifers in Thai water bodies, the first checklist was published in 2013, documenting approximately 398 species (Sa-Ardrit et al. 2013). However, the taxonomy and diversity of freshwater bdelloid rotifers, a distinct group within the phylum Rotifera, have only been intensively studied since 2016 (Jaturapruek et al. 2018, Jaturapruek et al. 2020, Jaturapruek et al. 2021). As a result, numerous additional species have been discovered in recent years, and the taxonomic status of several species has been revised. In this study, we present an updated and comprehensive checklist of freshwater rotifers in Thailand, incorporating recent taxonomic insights, nomenclatural updates, species diversity, and geographical distribution.

Materials and methods

Data collection

In this study, a checklist of freshwater rotifer species in Thailand was compiled from 41 published research papers (Table 1). Updated taxonomic names, based on the List of Available Names in Zoology (LAN) (Jersabek et al. 2018), were used consistently in all analyses. The occurrence of rotifers in Thailand was categorized into six geographical regions—northern, northeastern, central, western, eastern, and southern—based on mountain ranges and topography (Setapan 1999). Information on biogeographical distribution was primarily obtained from Segers (2007) and supplemented with additional literature, as summarized in Table 2. Species occurrences were classified into eight major biogeographical regions: Palearctic, Afrotropical, Oriental, Nearctic, Neotropical, Australian, Pacific, and Antarctic, following Segers (2007). The present dataset has been published in GBIF (DOI:

Table 1.
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References used for data collection.

1 = De Ridder (1971)	22 = Jithlang and Wongrat (2006)
2 = Koste (1975)	23 = Teeramaethee et al. (2006)
3 = Boonsom (1984)	24 = Chittapun et al. (2007)
4 = Sanoamuang et al. (1995)	25 = Sanoamuang (2007)
5 = Sanoamuang (1996)	26 = Athibai and Sanoamuang (2008)
6 = Pholpunthin (1997)	27 = Chittapun et al. (2009)
7 = Sanoamuang and Segers (1997)	28 = Segers and Savatenalinton (2010)
8 = Segers and Pholpunthin (1997)	29 = Chittapun (2011)

9 = Pholpunthin and Chittapun (1998)	30 = Meksuwan et al. (2011)
10 = Sanoamuang (1998)	31 = Athibai et al. (2013)
11 = Chittapun et al. (1999)	32 = Meksuwan et al. (2013)
12 = Sanoamuang and Savatenalinton (1999)	33 = Sa-ardrit et al. (2017)
13 = Chittapun and Pholpunthin (2001)	34 = Jaturapruek et al. (2018)
14 = Sanoamuang and Savatenalinton (2001)	35 = Meksuwan et al. (2018)
15 = Segers and Chittapun (2001)	36 = Jantawong and Maiphae (2020)
16 = Chittapun et al. (2002)	37 = Jaturapruek et al. (2020)
17 = Chittapun et al. (2003)	38 = Jaturapruek et al. (2021)
18 = Segers et al. (2004)	39 = Plangklang and Athibai (2021)
19 = Athibai et al. (2005)	40 = Maiphae et al. (2023)
20 = Chittapun et al. (2005)	41 = Jantawong et al. (2023)
21 = Savatenalinton and Segers (2005)	

Table 2.

Checklist of freshwater rotifers in Thailand. Habitat types are abbreviated as follows: CA = canal, D = dam, FF = fish field, IT = irrigation tank, L = lake, M = marsh, P = pond, PS = peat swamp, RE = reservoir, RF = rice field, RI = river, SW = swamp, TP = temporary pond. Distributions are represented as N = northern, NE = northeastern, C = central, E = eastern, W = western, S = southern, PAL = Palearctic, AFR = Afrotropical, ORI = Oriental, NEA = Nearctic, NEO = Neotropical, AUS = Australian, PAC = Pacific, ANT = Antarctic. References correspond to those listed in Table 1. * = Updated record from Sa-Ardrit et al. (2013).

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
Bdelloidea						
	Family Habrotrochidae					
1	*Habrotrocha ampulla* Murray, 1911	no information	C	AFR, NEA, NEO, ORI, PAL	2	
2	*Habrotrocha angusticollis* (Murray, 1905)	no information	C	AFR, ANT, AUS, NEA, NEO, ORI, PAL	2	
3	*Otostephanos donneri* Bartoš, 1959*	SW	S	AUS, ORI, PAL	34	
	Family Philodinidae					
4	*Dissotrocha aculeata* (Ehrenberg, 1830)	L, PS, SW	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 13, 16, 24, 34	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
5	*Dissotrocha macrostyla* (Ehrenberg, 1838)	L, SW	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 34	
6	*Philodina megalotrocha* Ehrenberg, 1832*	P, SW	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	34	
7	*Rotaria macrura* (Ehrenberg, 1832)*	SW	N, C	AFR, AUS, NEA, NEO, ORI, PAL	37	
8	*Rotaria megarostris* Jaturapruek, Fontaneto, Meksuwan, Pholpunthin & Maiphae, 2018*	CA, L, P, PS, SW	N, NE, C, E, W, S	ORI (Endemic to Thailand)	34, 37	
9	*Rotaria mento* (Anderson, 1889)*	CA, L, M, P, RF, SW	N, NE, C, E, W, S	NEA, ORI, PAL	34, 37	
10	*Rotaria neptunia* (Ehrenberg, 1830)*	CA, L, P, RF, RI, SW	N, NE, C, E, W, S	AFR, AUS, NEA, NEO, ORI, PAL	34, 37, 38	
11	*Rotaria neptunoida* Harring, 1913*	CA, M, P, PS, RF, SW	N, NE, C, W, S	AFR, AUS, NEA, ORI, PAL	34, 37	
12	*Rotaria ovata* (Anderson, 1889)*	P, PS, SW	N, NE, C, E, W, S	ORI (Known from India and Thailand)	34, 37	
13	*Rotaria rotatoria* (Pallas, 1766)*	CA, L, M, P, PS, SW	N, NE, C, W, S	AFR, AUS, NEA, NEO, ORI, PAL	34, 37, 38	
14	*Rotaria tardigrada* (Ehrenberg, 1830)*	CA, L, M, P, RI, SW	N, NE, C, E, W, S	AFR, AUS, NEA, NEO, ORI, PAL	34, 37, 38	
Monogononta						
	Family Asplanchnidae					
15	*Asplanchna brightwellii* Gosse, 1850	FF, L, P, RE, SW	NE, C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 14, 18, 21, 22, 23	Incl.: *Asplanchna brightwelli* Gosse, 1850 (Ref.1,4,14,18,22)
16	*Asplanchna priodonta* Gosse, 1850	CA, L, P, RE, RI, SW, TP	N, NE, C	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 5, 10, 14, 18, 21, 22, 23, 25	
17	*Asplanchna sieboldii* (Leydig, 1854)	CA, L, P, PS, RF, RI, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 18, 24, 25, 27, 29, 40	Incl.: *Asplanchna sieboldi* (Leydig, 1854) (Ref.4,10,18,24)

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
18	*Asplanchna tropica* Koste & Tobias, 1989	L, P	NE, S	AFR, ORI	4, 6, 8	
19	*Asplanchnopus hyalinus* Harring, 1913	P	NE	AFR, AUS, NEO, ORI, PAL	4, 18	
20	*Asplanchnopus multiceps* (Schrank, 1793)	CA, P, RF	NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 39	Incl.: *Asplachnopus multiceps* (Schrank, 1793) (Ref.4)
21	*Harringia rousseleti* Beauchamp, 1911	PS	S	NEA, NEO, ORI, PAL	24	
	Family Atrochidae					
22	*Acyclus inquietus* Leidy, 1882	L	S	NEA, ORI, PAL	30	
23	*Cupelopagis vorax* (Leidy, 1857)	L	C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 6, 8	
	Family Brachionidae					
24	*Anuraeopsis coelata* Beauchamp, 1932	CA, L, P, PS, RE, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 5, 6, 8, 18, 19, 21, 22, 23, 24, 25, 31, 36, 41	
25	*Anuraeopsis fissa* (Gosse, 1851)	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 31, 36, 39, 40, 41	
26	*Anuraeopsis navicula* Rousselet, 1911	L, P, PS, RE, RF, TP	NE, C, S	AUS, NEA, NEO, ORI, PAL	4, 6, 8, 11, 22, 24, 25, 27	
27	*Brachionus angularis* Gosse, 1851	CA, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 5, 6, 8, 10, 11, 14, 18, 19, 21, 22, 23, 24, 25, 27, 31, 33, 36, 39, 40, 41	Incl.: *Brachionus angularis* Gosse f. *typica*, f. *chelonis* (Ref.4)
28	*Brachionus angularis bidens* Plate, 1886	L, M, P, RE, RI, SW	N, NE, C, S	AFR, AUS, NEA, ORI, PAL	4, 31, 33	Incl.: *Brachionus angularis* f. *bidens* (Ref.4,31)

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
29	*Brachionus bennini* Leissling, 1924	P, RI	N, NE	AFR, AUS, NEA, ORI, PAL	4, 31	
30	*Brachionus bidentatus* Anderson, 1889	CA, L, P, RE, RI, SW, TP	N, NE, C	AFR, ANT, AUS, NEA, NEO, ORI, PAL	4, 14, 18, 22, 25, 31	Incl.: *Brachionus bidentatus* f. *inermis* (Ref.31)
31	*Brachionus budapestinensis* Daday, 1885	P, RE, RF, TP	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	4, 25, 31, 40, 41	
32	*Brachionus calyciflorus* Pallas, 1766	CA, FF, IT, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, W, S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 6, 8, 10, 14, 18, 19, 21, 22, 23, 24, 25, 27, 31, 33, 36, 40, 41	Incl.: *Brachionus calyciflorus* f. *typica*, f. *monstruosus*, f. *amphiceros* (Ref.4); f. *anuraeiformis* (Ref.31)
33	*Brachionus caudatus* Barrois & Daday, 1894	CA, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 6, 8, 10, 18, 21, 22, 23, 25, 26, 27, 31, 33, 36, 40, 41	Incl.: *Brachionus caudatus* f. *aculeatus* (Ref.4,23,31), *Brachionus caudatus* f. *apsteini* (Ref.23,26,31), *Brachionus caudatus* f. *personatus* (Ref.4)
34	*Brachionus dichotomus* Shephard, 1911	L, PS, RE	NE, C, S	AUS, ORI	6, 8, 22, 24	
35	*Brachionus dichotomus reductus* Koste & Shiel, 1980	CA, L, M, P, RE, RF, SW, TP	N, NE, C, E, S	AUS, ORI	4, 5, 10, 14, 18, 19, 21, 23, 25, 31, 33	Incl.: *Brachionus dichotomus* Shephard f. *reductus* Koste & Shiel, 1980 (Ref. 4,5,10,14,18,21,23,25,31)
36	*Brachionus diversicornis* (Daday, 1883)	CA, L, P, RE, RF, RI, SW, TP	N, NE, C, E	AFR, AUS, NEO, ORI, PAL	3, 4, 10, 18, 21, 22, 23, 25, 27, 31, 33, 36	
37	*Brachionus donneri* Brehm, 1951	CA, IT, L, P, PS, RE, RI, SW, TP	N, NE, C, S	ORI (Known from Thailand, Cambodia and India)	3, 4, 5, 6, 8, 10, 14, 18, 21, 23, 24, 25, 31, 33, 36, 41	
38	*Brachionus durgae* Dhanapathi, 1974	L, P, TP	NE, C	AFR, NEO, ORI, PAL	4, 25, 31	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
39	*Brachionus falcatus* Zacharias, 1898	CA, IT, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 5, 6, 8, 10, 11, 14, 18, 19, 21, 22, 23, 24, 25, 27, 29, 31, 33, 36, 40, 41	
40	*Brachionus forficula* Wierzejski, 1891	CA, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, W, S	AFR, AUS, ORI, PAL	1, 3, 4, 6, 8, 10, 14, 18, 19, 21, 22, 23, 24, 25, 27, 29, 31, 33, 36, 41	Incl.: *Brachionus forficula* f. *typica* , f. *reductus* (Ref.4), *Brachionus forficula* f. *minor* (Ref.31)
41	*Brachionus kostei* Shiel, 1983	CA, L, M, PS, RI	N, NE, S	AUS, ORI, PAL	4, 10, 18, 33	
42	*Brachionus leydigii* Cohn, 1862	FF	C	AFR, AUS, ORI, PAL	3	
43	*Brachionus lyratus* Shephard, 1911	CA, P, PS, RF, TP	NE, C, S	AUS, ORI	4, 18, 24, 25, 40, 41	
44	*Brachionus murphyi* Sudzuki, 1989	CA, L, P, PS, RF	N, NE, S	ORI (Known from Singapore, Thailand, China and India)	4, 6, 8, 18, 24, 31	Syn.: *Brachionus niwati* Sanoamuang, Segers & Dumont, 1995 (Ref.4,6,8)
45	*Brachionus nilsoni* Ahlstrom, 1940	L, RI, SW	N, C	AFR, AUS, NEA, NEO, ORI, PAL	23, 31	
46	*Brachionus plicatilis* Müller, 1786	FF, L, P, RE	NE	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4	
47	*Brachionus quadridentatus* Hermann, 1783	CA, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 6, 8, 10, 11, 13, 14, 16, 18, 19, 21, 22, 23, 24, 25, 27, 31, 33, 36, 39, 40, 41	Incl.: *Brachionus quadridentatus* f. *typica* (Ref.4), *Brachionus quadridentatus* f. *brevispinus* (Ref.4,19,31)
48	*Brachionus rotundiformis* Tschugunoff, 1921	CA, M, P, PS, RF, RI	NE, C, E, S	AFR, NEA, ORI, PAL	19, 20, 24, 27, 31, 33	
49	*Brachionus rubens* Ehrenberg, 1838	CA, L, P, PS, RE, RF, RI, TP	N, NE, C, S	AFR, NEA, NEO, ORI, PAL	4, 6, 8, 11, 18, 19, 21, 25, 27, 31	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
50	*Brachionus sericus* Rousselet, 1907	no information	no information	AFR, AUS, ORI, PAL	19	
51	*Brachionus sessilis* Varga, 1951	CA, P	NE	AFR, AUS, NEO, ORI, PAL	4	
52	*Brachionus srisumonae* Segers, Kothetip & Sanoamuang, 2004	CA, D, P, SW	NE	ORI (Known from Thailand and India)	18	
53	*Brachionus urceolaris* Müller, 1773	CA, FF, L, PS, RF	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	3, 4, 15, 19, 20, 24, 27, 29, 31	
54	*Brachionus variabilis* Hempel, 1896	PS	S	AUS, NEA, NEO, ORI, PAL	11	
55	*Keratella cochlearis* (Gosse, 1851)	CA, IT, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 5, 6, 8, 10, 14, 18, 19, 21, 22, 23, 24, 25, 31, 33, 36, 39, 40, 41	Incl.: *Keratella cochlearis* f. *typica* , f. *micracantha* (Ref.4)
56	*Keratella edmondsoni* Ahlstrom, 1943	CA, L, P, RE, SW	NE	ORI (Known from Thailand, Cambodia and India)	4, 14, 18, 19, 31	
57	*Keratella javana* Hauer, 1937	PS	S	AFR, AUS, ORI, PAL	13, 16	
58	*Keratella lenzi* Hauer, 1953	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, NEA, NEO, ORI	2, 4, 6, 8, 10, 14, 18, 19, 21, 22, 23, 25, 27, 31, 33, 36, 39	
59	*Keratella mixta* (Oparina-Charitonova, 1924)	PS	S	NEA, ORI, PAL	16	
60	*Keratella procurva* (Thorpe, 1891)	CA, FF, L, P, SW	N, NE, C	AFR, AUS, NEO, ORI, PAL	3, 4, 5, 18, 19, 21, 23, 31	
61	*Keratella taksinensis* Chittapun, Pholpunthin & Segers, 2002	PS	S	ORI (Endemic to Thailand)	16	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
62	*Keratella tecta* (Gosse, 1851)	CA, L, M, P, RE, RF, RI, SW	N, NE, C, E	AFR, AUS, NEA, NEO, ORI, PAL	4, 18, 19, 21, 22, 23, 31, 33, 39	
63	*Keratella tropica* (Apstein, 1907)	CA, IT, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, W, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 2, 3, 4, 5, 6, 8, 10, 11, 14, 18, 19, 21, 22, 23, 24, 25, 27, 31, 33, 36, 39, 40, 41	Syn.: *Keratella valga tropica* Apstein, 1907 (Ref.2), *Kellatella valga* (Ehrenberg, 1834) (Ref.3)
64	*Plationus patulus* (Müller, 1786)	CA, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 6, 8, 10, 11, 13, 14, 16, 18, 19, 21, 22, 23, 24, 25, 27, 31, 33, 36, 39, 40, 41	Syn.: *Brachionus patulus* Müller, 1786 (Ref.3), *Plationus patulus* (Müller) f. *typica* (Ref.4)
65	*Platyias leloupi* Gillard, 1957*	P, RF, SW	N, NE, S	AFR, AUS, NEA, NEO, ORI	33, 39	
66	*Platyias quadricornis* (Ehrenberg, 1832)	CA, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 6, 8, 10, 11, 14, 16, 18, 19, 22, 23, 24, 25, 27, 31, 33, 39, 40, 41	Incl.: *Platyias quadricornis* f. *brevispinus* (Ref.16)
	Family Collothecidae					
67	*Collotheca algicola* (Hudson, 1886)	L	S	ORI, PAL	30, 32	
68	*Collotheca ambigua* (Hudson, 1883)	L	S	AFR, AUS, NEA, NEO, ORI, PAL	30, 32	
69	*Collotheca campanulata* (Dobie, 1849)	CA, L, RE	NE, S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	4, 30, 32	Incl.: *Collotheca campanulata* var. *longicaudata* (Ref.30)
70	*Collotheca edentata* (Collins, 1872)	no information	C	AUS, NEA, NEO, ORI, PAL	2	
71	*Collotheca ferox* (Penard, 1914)*	no information	no information	ORI, PAC, PAL	32	
72	*Collotheca heptabrachiata* (Schoch, 1869)	L	S	AFR, NEA, NEO, ORI, PAL	30, 32	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
73	*Collotheca orchidacea* Meksuwan, Pholpunthin & Segers, 2013*	L	S	ORI (Endemic to Thailand)	32	
74	*Collotheca ornata* (Ehrenberg, 1830)	L, SW	S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	30, 32	
75	*Collotheca stephanochaeta* Edmondson, 1936	L	S	NEA, ORI, PAL	30, 32	
76	*Collotheca tenuilobata* (Anderson, 1889)	L	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	14, 30, 32	
77	*Collotheca trilobata* (Collins, 1872)	L, SW	C, S	AFR, AUS, NEA, ORI, PAL	23, 30, 32	Incl.: *Collotheca* cf. *trilobata* (Collins, 1872) (Ref.23)
78	*Stephanoceros fimbriatus* (Goldfusz, 1820)	L	S	AUS, NEA, NEO, ORI, PAL	30, 32	
79	*Stephanoceros millsii* (Kellicott, 1885)	L	S	NEA, ORI	30, 32	Incl.: *Stephanoceros fimbriatus* var. *millsii* (Kellicott, 1885) (Ref. 30)
	Family Conochilidae					
80	*Conochilus coenobasis* (Skorikov, 1914)	L, P, RE, TP	NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 14, 21, 25	
81	*Conochilus dossuarius* Hudson, 1885	CA, P, RF	N, NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 10	
82	*Conochilus hippocrepis* (Schrank, 1803)	L, P, TP	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 21, 25, 30	
83	*Conochilus natans* (Seligo, 1900)	CA, L, PS, TP	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 14, 21, 24, 25	
84	*Conochilus unicornis* Rousselet, 1892	L, RE	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	3, 14	
	Family Dicranophoridae					
85	*Aspelta circinator* (Gosse, 1886)	L	NE	AUS, NEA, NEO, ORI, PAL	14	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
86	*Dicranophoroides caudatus* (Ehrenberg, 1834)	CA, L, P	N, NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 14, 18, 21	Syn.: *Dicranophorus caudatus* (Ehrenberg, 1834) (Ref.4,14)
87	*Dicranophoroides claviger* (Hauer, 1965)	L, P, TP	NE, S	AFR, NEO, ORI	4, 6, 8, 14, 18, 25	Syn.: *Dicranophorus claviger* (Hauer) (Ref.4,6,8)
88	*Dicranophorus epicharis* Harring & Myers, 1928	L, P, PS, RF	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 11, 13, 14, 18, 21, 24, 27	Incl.: *Dicranophorus* cf. *epicharis* Harring & Myers, 1928 (Ref.4)
89	*Dicranophorus grandis* (Ehrenberg, 1832)	CA, L, P	N, NE	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 10, 14	
90	*Dicranophorus prionacis* Harring & Myers, 1928	L	S	AFR, NEA, NEO, ORI, PAL	6, 8	
91	*Dicranophorus robustus* Harring & Myers, 1928	FF	C	AFR, AUS, NEA, NEO, ORI, PAL	3	
92	*Encentrum longidens* Donner, 1943	PS	S	ORI, PAL	15	
93	*Encentrum pornsilpi* Segers & Chittapun, 2001	PS	S	ORI (Endemic to Thailand)	15, 20, 24	
	Family Epiphanidae					
94	*Cyrtonia tuba* (Ehrenberg, 1834)	L	S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	6, 8	
95	*Epiphanes clavulata* (Ehrenberg, 1831)	CA, L, P, RF, TP	N, NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 18, 21, 25	
96	*Epiphanes macroura* (Barrois & Daday, 1894)	CA, L, P	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	Incl.: *Epiphanes macrourus* (Barrois & Daday, 1894) (Ref.4)
97	*Proalides subtilis* Rodewald, 1940	P	NE	AFR, AUS, NEO, ORI, PAL	4	
98	*Proalides tentaculatus* Beauchamp, 1907	P	NE	AFR, NEA, NEO, ORI, PAC, PAL	4	
	Family Euchlanidae					

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
99	*Beauchampiella eudactylota* (Gosse, 1886)	CA, P, PS, RF, RI	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 16, 18, 39	Syn.: *Manfredium eudactylotum* (Gosse, 1886) (Ref.4,10,16,18)
100	*Dipleuchlanis propatula* (Gosse, 1886)	CA, L, P, PS, RE, RF, RI, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 6, 8, 10, 13, 14, 16, 18, 21, 24, 25, 27, 39, 40	Incl.: *Dipleuchlanis propatula* f. *macrodactyla* (Ref.16)
101	*Euchlanis dilatata* Ehrenberg, 1832	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 2, 3, 4, 6, 8, 10, 11, 13, 14, 18, 21, 23, 24, 25, 27, 40	
102	*Euchlanis incisa* Carlin, 1939	L, P, PS, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 10, 11, 13, 14, 16, 18, 21, 23, 25, 39	Incl.: *Euchlanis incisa* f. *mucronata* (Ref.11)
103	*Euchlanis lyra* Hudson, 1886	PS	S	AFR, AUS, NEA, NEO, ORI	11	Incl.: *Euchlanis lyra* f. *myersi* (Ref.11)
104	*Euchlanis meneta* Myers, 1930	L, PS	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 11, 14	
105	*Euchlanis triquetra* Ehrenberg, 1838	no information	C	AFR, AUS, NEA, NEO, ORI, PAL	2	
106	*Tripleuchlanis plicata* (Levander, 1894)	CA, FF, L, P, RE, RF, SW	N, NE, C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 10, 14, 18, 22, 23, 39	
	Family Flosculariidae					
107	*Beauchampia crucigera* (Dutrochet, 1812)	L	C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 30	Syn.: *Beauchampia crucigera crucigera* (Dutrochet, 1812) (Ref.2)
108	*Floscularia armata* Segers, 1997	L	S	NEA, NEO, ORI	30	
109	*Floscularia bifida* Segers, 1997	L	S	NEA, NEO, ORI	30	
110	*Floscularia conifera* (Hudson, 1886)	L, PS	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 13, 14, 18, 20, 24, 30	
111	*Floscularia decora* Edmondson, 1940	no information	C	NEO, ORI	2	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
112	*Floscularia melicerta* (Ehrenberg, 1832)	no information	C	AFR, AUS, NEA, NEO, ORI, PAL	2	
113	*Floscularia pedunculata* (Joliet, 1883)	L	S	NEA, ORI, PAL	30	
114	*Floscularia ringens* (Linnaeus, 1758)	L	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 14, 30	
115	*Floscularia wallacei* Segers & Shiel, 2008	L	S	AUS, ORI	30	
116	*Lacinularia flosculosa* (Müller, 1773)	L	S	AUS, NEA, NEO, ORI, PAL	30	
117	*Lacinularoides coloniensis* (Colledge, 1918)	L	S	AUS, NEA, NEO, ORI, PAL	30	
118	*Limnias ceratophylli* Schrank, 1803	L	C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 30	It is a species complex.
119	*Limnias lenis* Meksuwan, Jaturapruek & Maiphae, 2018*	PS	S	ORI (Endemic to Thailand)	35	
120	*Limnias melicerta* Weisse, 1848	L, PS, SW	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 15, 30, 35	It is a species complex.
121	*Limnias novemceras* Meksuwan, Jaturapruek & Maiphae, 2018*	RI	S	ORI (Endemic to Thailand)	35	
122	*Octotrocha speciosa* Thorpe, 1893	L	S	AUS, NEA, NEO, ORI, PAL	30	
123	*Pentatrocha gigantea* Segers & Shiel, 2008	L	S	AUS, ORI	30	
124	*Ptygura agassizi* Edmondson, 1948	L	S	NEA, ORI	30	
125	*Ptygura barbata* Edmondson, 1939	L	S	AUS, NEA, NEO, ORI	30	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
126	*Ptygura beauchampi* Edmondson, 1940	L	S	NEA, NEO, ORI, PAL	30	
127	*Ptygura brachiata* (Hudson, 1886)	no information	C	AFR, AUS, NEA, NEO, ORI, PAL	2	
128	*Ptygura crystallina* (Ehrenberg, 1834)	L	S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	30	
129	*Ptygura ctenoida* Koste & Tobias, 1990	L	S	AFR, AUS, ORI, PAL	30	
130	*Ptygura elsteri* Koste, 1972	L	C, S	NEO, ORI	2, 30	Syn.: *Ptygura elsteri elsteri* Koste, 1972 (Ref.2)
131	*Ptygura furcillata* (Kellicott, 1889)	L	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 14, 30	Syn.: *Ptygura furcillata furcillata* (Kellicott, 1889) (Ref.2), Incl.: *Ptygura furcillata* f. *variabilis* (Ref.2)
132	*Ptygura kostei* José de Paggi, 1996	L	NE	AFR, NEO, ORI	2, 14	Syn.: *Ptygura elsteri* f. *thailandensis* Koste, 1975 (Ref. 2,14)
133	*Ptygura longicornis* (Davis, 1867)	L	S	AUS, NEA, NEO, ORI, PAL	30	
134	*Ptygura melicerta* Ehrenberg, 1832	L	NE, C	AFR, ANT, AUS, NEA, NEO, ORI, PAL	2, 14	
135	*Ptygura mucicola* (Kellicott, 1888)	L	C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 30	
136	*Ptygura noodti* (Koste, 1972)	L	S	NEO, ORI	30	
137	*Ptygura pedunculata* Edmondson, 1939	L	S	NEA, NEO, ORI, PAL	30	
138	*Ptygura tacita* Edmondson, 1940	L	NE, S	AUS, NEA, NEO, ORI	14, 30	
139	*Ptygura thalenoiensis* Meksuwan, Pholpunthin & Segers, 2011	L	S	ORI (Known from Thailand and Cambodia)	30	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
140	*Ptygura wilsonii* (Anderson & Shephard, 1892)	L	S	AFR, AUS, NEO, ORI, PAL	30	
141	*Sinantherina ariprepes* Edmondson, 1939	L, SW	NE, C	AUS, NEA, NEO, ORI	14, 21, 23	Incl.: *Sinantherina ariprepes* Edmondson, 1939 (Ref.14,21), *S. areprepes* Edmondson, 1939 (Ref.23)
142	*Sinantherina semibullata* (Thorpe, 1889)	CA, L, P, RF	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 21, 30	
143	*Sinantherina socialis* (Linnaeus, 1758)	L	C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 30	
144	*Sinantherina spinosa* (Thorpe, 1893)	L, P, RF, SW, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 14, 18, 21, 23, 25, 27, 30, 39	
	Family Gastropodidae					
145	*Ascomorpha agilis* Zacharias, 1893	RE	C	AFR, ORI, PAL	22	
146	*Ascomorpha ecaudis* Perty, 1850	CA, L, P, RE, RI	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 10, 21, 22	
147	*Ascomorpha ovalis* (Bergendal, 1892)	CA, L, P, PS, RE, RI, SW, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 8, 14, 18, 21, 22, 23, 24, 25	
148	*Ascomorpha saltans* Bartsch, 1870	FF, L, P, RE, SW	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 6, 8, 14, 18, 21, 22, 23	
149	*Gastropus hyptopus* (Ehrenberg, 1838)	L, P, RI	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	
	Family Hexarthridae					
150	*Hexarthra fennica* (Levander, 1892)	L, P	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	
151	*Hexarthra intermedia* (Wiszniewski, 1929)	CA, L, P, RE, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 5, 6, 8, 10, 14, 18, 21, 22, 23, 25	
152	*Hexarthra mira* (Hudson, 1871)	CA, L, P, PS, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 6, 8, 10, 14, 18, 20, 21, 23, 24, 25, 39	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
153	*Hexarthra oxyuris* (Zernov, 1903)	P	NE	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4	
	Family Ituridae					
154	*Itura aurita* (Ehrenberg, 1830)	P	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	
155	*Itura symmetrica* Segers, Mbogo & Dumont, 1994	L	NE	AFR, AUS, ORI	4	
	Family Lecanidae					
156	*Lecane abanica* Segers, 1994	P, PS	S	AFR, ORI, PAL	13, 24, 28, 33	
157	*Lecane acanthinula* (Hauer, 1938)	P, PS (they have been recorded in slightly brackish water)	NE, S	ORI, PAL	4, 7, 15, 24, 28	
158	*Lecane aculeata* (Jakubski, 1912)	CA, FF, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 3, 4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 28, 29, 33, 40	
159	*Lecane acus* (Harring, 1913)	FF, P, SW	C, S	AUS, NEA, NEO, ORI, PAL	1, 3, 33	
160	*Lecane aeganea* Harring, 1914	FF, P, RE, RF	N, NE, C	AFR, AUS, NEA, NEO, ORI	3, 4, 10, 22, 28	Incl.: *Lecane aegana* Harring, 1914 (Ref.22)
161	*Lecane arcuata* (Bryce, 1891)	FF, P, PS	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 2, 3, 4, 11, 13, 28	
162	*Lecane arcula* Harring, 1914	L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 9, 10, 11, 14, 16, 18, 21, 22, 23, 24, 25, 28, 33, 39	Syn.: *Lecane strandi* Bērziņš, 1943 (Ref.22)
163	*Lecane armata* Thomasson, 1971	RE	E	NEO, ORI	28	
164	*Lecane aspasia* Myers, 1917	CA, L, P, RF	N, NE	NEA, NEO, ORI, PAL	4, 10, 18, 28	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
165	*Lecane baimaii* Sanoamuang & Savatenalinton, 1999	CA, RE, RF, SW	NE	AFR, ORI	12, 18, 28, 39	
166	*Lecane batillifer* (Murray, 1913)	L, P, PS, RE, SW	NE, C, S	AUS, ORI	4, 6, 8, 18, 21, 23, 24, 28, 33	
167	*Lecane bifastigata* Hauer, 1938	P, SW	NE, C	ORI, PAL	4, 7, 23, 28	
168	*Lecane bifurca* (Bryce, 1892)	L, PS, TP	NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	6, 8, 11, 20, 21, 24, 25, 28	
169	*Lecane blachei* Bērziņš, 1973	CA, D, L, P, RE	N, NE, C, S	ORI (Known from Cambodia, Indonesian Borneo, India and Thailand)	4, 7, 9, 10, 14, 18, 21, 28	
170	*Lecane braumi* Koste, 1988	L, PS, SW	NE, E, S	AFR, AUS, ORI	5, 13, 14, 16, 28, 33	
171	*Lecane bulla* (Gosse, 1851)	CA, D, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 25, 27, 28, 29, 33, 36, 39, 40, 41	Syn.: *Lecane bulla bulla* (Gosse, 1851) (Ref.28)
172	*Lecane bulla diabolica* (Hauer, 1936)	L	S	ORI (Known from Thailand and India)	28	
173	*Lecane calcaria* Harring & Myers, 1926	L, PS	NE, S	NEA, ORI	8, 13, 18, 28	
174	*Lecane chinesensis* Zhuge & Koste, 1996	RE, RF	C, S	ORI, PAL	28, 40	
175	*Lecane clara* (Bryce, 1892)	L, M, P, PS	NE, S	AFR, NEA, NEO, ORI, PAC, PAL	6, 8, 13, 21, 28, 33	
176	*Lecane closterocerca* (Schmarda, 1859)	CA, FF, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 2, 3, 4, 6, 8, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 39, 40	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
177	*Lecane cornuta* (Müller, 1786)	FF, P	C	NEA, NEO, ORI, PAL	1, 2, 3, 41	
178	*Lecane crenata* (Harring, 1913)	L, PS, SW	NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 28, 33	
179	*Lecane crepida* Harring, 1914	CA, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 6, 8, 10, 11, 13, 14, 18, 21, 23, 24, 25, 28, 33, 39	
180	*Lecane curvicornis* (Murray, 1913)	CA, D, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 6, 8, 9, 10, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 29, 33, 36, 39, 40, 41	Incl.: *Lecane curvicornis* f. *typica* (Ref.4)
181	*Lecane decipiens* (Murray, 1913)	CA, L, P, PS, RE, RI, SW, TP	NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	11, 12, 13, 14, 18, 21, 25, 28, 33	
182	*Lecane donneri* Chengalath & Mulamoottil, 1974	P, TP	NE	AFR, NEA, ORI	12, 18, 25, 28	
183	*Lecane doryssa* Harring, 1914	CA, L, P, PS, RF, TP	N, NE, S	AFR, AUS, NEO, ORI, PAL	4, 10, 13, 14, 16, 18, 21, 24, 25, 28	Incl.: *Lecane* cf. *doryssa* Harring, 1914 (Ref.14)
184	*Lecane elegans* Harring, 1914	CA, L, RF, TP	N, NE, C	AFR, NEO, ORI, PAC, PAL	2, 10, 14, 18, 21, 25, 27, 28, 29, 39	
185	*Lecane enowi* Segers and Mertens, 1997	PS	S	AFR, ORI	16, 28	
186	*Lecane eswari* Dhanapathi, 1976	P	NE	AFR, ORI	7, 18, 28	
187	*Lecane flexilis* (Gosse, 1886)	L, P, PS, SW	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 11, 14, 18, 21, 23, 24, 28	
188	*Lecane furcata* (Murray, 1913)	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 28	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
189	*Lecane galeata* (Bryce, 1892)	no information	C	NEA, ORI, PAL	2	Syn.: *Lecane* (*Monostyla*) *pygmaea* Daday, 1897 (Ref.2)
190	*Lecane grandis* (Murray, 1913)	PS	NE, S	AUS, NEA, NEO, ORI, PAL	11, 12, 24, 28, 33	
191	*Lecane haliclysta* Harring & Myers, 1926	CA, L, P, PS, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 13, 14, 18, 21, 23, 24, 25, 28, 33, 39	
192	*Lecane hamata* (Stokes, 1896)	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 5, 6, 8, 9, 10, 11, 13, 14, 15, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 36, 39, 40, 41	
193	*Lecane hastata* (Murray, 1913)	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 5, 10, 18, 21, 22, 23, 24, 25, 28, 33, 39	
194	*Lecane hornemanni* (Ehrenberg, 1834)	CA, D, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 5, 6, 8, 9, 10, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 39, 40	
195	*Lecane inermis* (Bryce, 1892)	L, P, PS, RF	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 6, 8, 11, 13, 16, 20, 21, 24, 27, 28	
196	*Lecane inopinata* Harring & Myers, 1926	FF, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 10, 11, 13, 14, 18, 21, 22, 23, 25, 28, 29, 39	
197	*Lecane intrasinuata* (Olofsson, 1917)	no information	C	NEA, ORI, PAL	2	
198	*Lecane isanensis* Sanoamuang & Savatenalinton, 2001	L	NE	ORI (Known from Thailand and India)	14, 28	
199	*Lecane junki* Koste, 1975	L, PS	C, S	ORI (Endemic to Thailand)	2, 7, 17, 28	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
200	*Lecane kunthuleensis* Chittapun, Pholpunthin & Segers, 2003	PS	S	ORI (Known from Thailand, Vietnam and China)	17, 28	
201	*Lecane lamellata* (Daday, 1893)	FF	C	NEA, ORI, PAL	3	
202	*Lecane lateralis* Sharma, 1978	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, ORI	4, 5, 6, 8, 9, 10, 11, 14, 16, 18, 21, 24, 25, 27, 28, 29, 33, 39, 40	
203	*Lecane latissima* Yamamoto, 1955	L, P, RE, SW	NE, S	AUS, NEA, ORI, PAL	4, 7, 9, 14, 18, 21, 28, 33	Syn.: *Lecane thailandensis* Segers & Sanoamuang, 1994 (Ref.4,7,9,14,18,21)
204	*Lecane lauterborni* Hauer, 1924	FF	C	AFR, NEA, NEO, ORI, PAC, PAL	3, 28	
205	*Lecane leontina* (Turner, 1892)	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 5, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 39, 41	Highly variable morphospecies
206	*Lecane ludwigii* (Eckstein, 1883)	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 20, 21, 23, 24, 25, 28, 33, 39, 41	
207	*Lecane luna* (Müller, 1776)	CA, D, FF, L, M, P, PS, RE, RF, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 6, 8, 9, 10, 11, 14, 18, 21, 22, 23, 24, 25, 27, 28, 29, 33, 39, 40, 41	
208	*Lecane lunaris* (Ehrenberg, 1832)	CA, D, FF, L, M, P, PS, RE, RF, SW, TP	N, NE, C, E, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	2, 3, 4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 28, 33, 36, 39, 41	Highly variable morphospecies
209	*Lecane lungae* Savatenalinton & Segers, 2005	RE	NE	ORI (Endemic to Thailand)	21, 28	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
210	*Lecane martensi* Savatenalinton & Segers, 2008	no information	C	ORI (Endemic to Thailand)	28	
211	*Lecane micrognatha* Segers & Savatenalinton, 2010	RF, RI	N, NE	ORI (Endemic to Thailand)	28	
212	*Lecane minuta* Segers, 1994	L, M, P	S	ORI (Known from Borneo, Thailand, India and Vietnam)	6, 7, 8, 28, 33	
213	*Lecane mitis* Harring & Myers, 1926	PS	S	NEA, NEO, ORI	13, 28	
214	*Lecane monostyla* (Daday, 1897)	FF, L, P, PS, RF, SW, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 11, 13, 16, 18, 23, 24, 25, 28, 33, 39	
215	*Lecane nana* (Murray, 1913)	FF, L, P, RF	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 6, 8, 14, 18, 21, 28, 29, 33	
216	*Lecane nelsoni* Segers, 1994	L	NE	AFR, NEO, ORI	14, 28	
217	*Lecane nitida* (Murray, 1913)	L, P, PS, RE, RF, SW	N, NE, E, S	AFR, AUS, NEO, ORI	4, 28, 33, 39	Syn.: *Lecane curvicornis* (Murray) f. *nitida* (Murray) (Ref. 4)
218	*Lecane niwati* Segers, Kothetip & Sanoamuang, 2004	D, L, RI	NE	ORI (Known from Thailand and India)	18, 28	
219	*Lecane obtusa* (Murray, 1913)	CA, D, L, M, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 9, 10, 11, 13, 14, 15, 16, 18, 20, 21, 23, 24, 25, 28, 33, 39	
220	*Lecane opias* (Harring & Myers, 1926)	RI	NE	AFR, NEA, ORI, PAL	21, 28	
221	*Lecane palinacis* Harring & Myers, 1926	PS, RF	C, S	NEA, ORI, PAC	13, 24, 27, 28, 29	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
222	*Lecane papuana* (Murray, 1913)	CA, D, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 25, 27, 28, 29, 33, 39, 40, 41	
223	*Lecane paxiana* Hauer, 1940	RE	NE, C	AFR, ORI, PAC, PAL	21, 28	
224	*Lecane pertica* Harring & Myers, 1926	CA, L, PS	N, NE, S	AFR, AUS, NEA, NEO, ORI	6, 8, 10, 13, 14, 16, 18, 28	
225	*Lecane punctata* (Murray, 1913)	FF, L, P, RE, SW	NE, C, S	AFR, NEA, NEO, ORI, PAL	3, 12, 21, 22, 23, 28, 33	Syn.: *Lecane harringi* Ahlstrom, 1934 (Ref.3,22)
226	*Lecane pusilla* Harring, 1914	L, PS, RF	N, NE, S	AFR, AUS, NEO, ORI, PAL	4, 10, 13, 14, 18, 21, 28, 39	
227	*Lecane pyriformis* (Daday, 1905)	L, M, P, PS, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 11, 13, 14, 15, 16, 18, 21, 23, 24, 25, 27, 28, 33, 39	
228	*Lecane quadridentata* (Ehrenberg, 1830)	CA, D, FF, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 2, 3, 4, 6, 8, 9, 10, 11, 13, 14, 18, 23, 24, 25, 27, 28, 33, 39, 40, 41	
229	*Lecane rhenana* Hauer, 1929	L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, NEO, ORI, PAL	4, 6, 8, 9, 10, 14, 18, 21, 23, 24, 25, 27, 28, 33	
230	*Lecane rhytida* Harring & Myers, 1926	CA, L, M, PS, RF, SW	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI	6, 8, 10, 11, 13, 15, 18, 23, 24, 28, 33	
231	*Lecane robertsonae* Segers, 1993	PS	NE, S	AUS, NEO, ORI	18, 21, 24, 28	
232	*Lecane ruttneri* Hauer, 1938	L, TP	NE	AFR, NEO, ORI	4, 14, 18, 21, 25, 28	
233	*Lecane segersi* Sanoamuang, 1996	PS, RF, SW	NE, C, S	ORI (Endemic to Thailand)	5, 7, 15, 18, 21, 24, 27, 28	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
234	*Lecane serrata* (Hauer, 1938)	no information	NE	AFR, AUS, ORI	12, 18, 28	
235	*Lecane shieli* Segers & Sanoamuang, 1994	L, PS, RE, RI	NE, S	AUS, ORI, PAL	4, 7, 11, 14, 18, 21, 28	
236	*Lecane signifera* (Jennings, 1896)	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 5, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 39, 40, 41	Incl.: *Lecane ploenensis* (Voigt, 1902) (Ref.2)
237	*Lecane simonneae* Segers, 1993	L, PS	NE, S	AFR, ORI	13, 14, 16, 18, 28	
238	*Lecane sola* Hauer, 1936	FF, P, TP	NE	NEO, ORI	3, 4, 18, 21, 25, 28	
239	*Lecane stenroosi* (Meissner, 1908)	CA, L, P, PS, RE, RF, RI, SW	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 9, 10, 11, 18, 21, 22, 23, 27, 28, 33, 39, 40	Incl.: *Lecane stenroosi* f. *lineata* (Meissner, 1908) (Ref.22)
240	*Lecane stichaea* Harring, 1913	RE	C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 22, 28	
241	*Lecane stichoclysta* Segers, 1993	RE	NE	AFR, ORI	21, 28	
242	*Lecane subtilis* Harring & Myers, 1926	PS	NE, S	AFR, NEA, NEO, ORI, PAL	18, 24, 28	
243	*Lecane superaculeata* Sanoamuang & Segers, 1997	CA, P, PS, RE, SW	N, NE, C, S	ORI (Known from Thailand, India, Vietnam and Cambodia)	7, 10, 16, 18, 24, 28, 33	
244	*Lecane sympoda* Hauer, 1929	L	S	AFR, ORI, PAL	6, 8, 28	
245	*Lecane syngenes* (Hauer, 1938)	PS	S	AFR, AUS, NEO, ORI, PAC	13, 28	
246	*Lecane tenuiseta* Harring, 1914	L, P, PS, RE, RF, RI, SW, TP	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 6, 8, 9, 11, 13, 14, 16, 18, 20, 21, 22, 23, 24, 25, 28, 29, 39	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
247	*Lecane thalera* (Harring & Myers, 1926)	L, P, SW	NE, C, S	AUS, NEA, NEO, ORI, PAL	4, 23, 28, 33	
248	*Lecane thienemanni* (Hauer, 1938)	P, PS, RE, RF, RI, SW, TP	NE, C, S	AFR, AUS, NEO, ORI	12, 13, 18, 21, 22, 23, 24, 25, 27, 28, 39	
249	*Lecane undulata* Hauer, 1938	CA, L, P, PS, RF, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 10, 13, 14, 18, 21, 24, 25, 28, 29, 33	
250	*Lecane unguitata* (Fadeev, 1925)	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, ORI, PAL	4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 20, 21, 23, 24, 25, 27, 28, 33, 39, 40	
251	*Lecane ungulata* (Gosse, 1887)	CA, D, L, M, P, PS, RE, RF, RI, SW, TP	N, NE, C, E, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 6, 8, 9, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 28, 33, 36, 40, 41	
	Family Lepadellidae					
252	*Colurella adriatica* Ehrenberg, 1831	FF, L, P, PS, TP	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 13, 14, 21, 24, 25	
253	*Colurella colurus* (Ehrenberg, 1830)	L, PS, RF	N, NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	2, 4, 10, 11, 13, 16, 24, 27	
254	*Colurella colurus compressa* (Lucks, 1912)	PS	S	ANT, AUS, NEA, NEO, ORI, PAL	15	
255	*Colurella hindenburgi* Steinecke, 1917	RE	C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	22	
256	*Colurella obtusa* (Gosse, 1886)	L, P, PS, RE, RF, TP	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 6, 8, 11, 13, 14, 15, 16, 18, 21, 22, 24, 25, 39	
257	*Colurella psammophila* Segers & Chittapun, 2001	PS	S	ORI (Known from Thailand and China)	15, 24	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
258	*Colurella sanoamuangae* Chittapun, Pholpunthin & Segers, 1999	PS, RF	NE, C, S	ORI (Known from Thailand, India and China)	11, 15, 24, 27, 39	
259	*Colurella sulcata* (Stenroos, 1898)	L, PS	NE, S	AFR, NEA, NEO, ORI, PAL	13, 14, 21, 24	
260	*Colurella tesselata* (Glascott, 1893)	PS	S	AFR, AUS, NEA, NEO, ORI, PAL	13, 24	
261	*Colurella uncinata* (Müller, 1773)	CA, L, P, PS, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	6, 8, 10, 13, 14, 16, 18, 21, 23, 24, 25, 27, 39	
262	*Colurella uncinata bicuspidata* (Ehrenberg, 1830)	CA, L, P, RI	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	Syn.: *Colurella uncinata* (Müller) f. *bicuspidata* (Ehrenberg) (Ref. 4,16)
263	*Lepadella acuminata* (Ehrenberg, 1834)	FF, L, P, PS, RE, RF, TP	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 11, 14, 18, 21, 22, 24, 25, 27	
264	*Lepadella akrobeles* Myers, 1934	CA, P, RF, SW	NE	AUS, NEA, ORI	12, 18, 39	
265	*Lepadella amphitropis* Harring, 1916	no information	NE	AFR, AUS, NEA, NEO, ORI, PAL	21	
266	*Lepadella apsicora* Myers, 1834	L, P, PS, RF, TP	NE, S	AFR, AUS, NEA, NEO, ORI	4, 6, 8, 14, 16, 18, 21, 24, 25, 39	
267	*Lepadella apsida* Harring, 1916	L, PS, RF	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 11, 14, 24, 39	
268	*Lepadella benjamini* Harring, 1916	L	NE	AFR, AUS, NEA, NEO, ORI, PAL	14, 18	
269	*Lepadella biloba* Hauer, 1958	L, RE	NE, S	AFR, AUS, NEO, ORI, PAL	4, 6, 8, 14, 18	
270	*Lepadella costatoides* Segers, 1992	CA, L, P, PS, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 14, 18, 21, 23, 24, 25, 39	
271	*Lepadella cristata* (Rousselet, 1893)	L, PS	NE, S	AFR, NEA, NEO, ORI, PAL	13, 14	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
272	*Lepadella dactyliseta* (Stenroos, 1898)	L, P, PS, RF, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 13, 25, 39, 40	Syn.: *Lepadella voigti* Hauer, 1931 (Ref.39)
273	*Lepadella desmeti* Segers & Chittapun, 2001	PS	S	NEO, ORI, PAC	15, 24	
274	*Lepadella discoidea* Segers, 1993	CA, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, ORI	4, 10, 11, 13, 14, 16, 18, 23, 25, 39	
275	*Lepadella ehrenbergii* (Perty, 1850)	CA, L, P, PS, RE, SW	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 14, 16, 18, 21, 23, 24	Incl.: *Lepadella ehrenbergi* (Perty, 1850) (Ref. 4,10,14,16,18,21,23,24)
276	*Lepadella elliptica* Wulfert, 1939	FF	NE, C	ANT, AUS, NEO, ORI, PAL	3, 21	
277	*Lepadella elongata* Koste, 1992	L	NE	NEO, ORI, PAC	12, 14, 18, 21	Incl.: *Lepadella* cf. *elongata* Koste, 1992 (Ref.14)
278	*Lepadella eurysterna* Myers, 1942	L, PS	NE, S	AFR, NEA, ORI, PAL	14, 18, 24	
279	*Lepadella heterostyla* (Murray, 1913)	L	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	6, 8, 18, 21	
280	*Lepadella latusinus* (Hilgendorf, 1899)	CA, L, P, PS, RE, RF	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 6, 8, 10, 14, 24	
281	*Lepadella lindaui* Koste, 1981	L, RF	NE, C, S	AFR, AUS, NEO, ORI	6, 8, 14, 18, 21, 29	
282	*Lepadella minoruoides* Koste & Robertson, 1983	L, PS	S	AFR, NEO, ORI	6, 8, 24	
283	*Lepadella monodactyla* Bērziņš, 1960	L, PS	NE, C, S	AFR, AUS, NEA, NEO, ORI	2, 14, 16, 24	Syn.: *Lepadella monostyla* f. *caudata* (Koste, 1972) (Ref.2)
284	*Lepadella ovalis* (Müller, 1786)	CA, FF, L, PS, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 3, 4, 6, 8, 10, 11, 13, 14, 18, 21, 23, 24, 25, 27, 39	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
285	*Lepadella patella* (Müller, 1773)	CA, FF, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	2, 3, 4, 6, 8, 10, 11, 13, 14, 16, 18, 21, 23, 24, 25, 27, 39	
286	*Lepadella punctata* Wulfert, 1939	PS	S	ORI, PAL	17	
287	*Lepadella quadricarinata* (Stenroos, 1898)	L, PS, RF	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 10, 11, 13, 14, 18	
288	*Lepadella quinquecostata* (Lucks, 1912)	CA, L	N, NE	AFR, AUS, NEA, NEO, ORI, PAC, PAL	10, 14, 18	
289	*Lepadella rhomboides* (Gosse, 1886)	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 5, 6, 8, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 39	
290	*Lepadella triba* Myers, 1934	L, PS, RF, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	2, 6, 8, 11, 14, 18, 21, 24, 25, 39	
291	*Lepadella triptera* (Ehrenberg, 1830)	L, PS, RF, RI	NE, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	4, 14, 18, 21, 24, 39	Incl.: *Lepadella triptera* f. *alata* (Ref.14,18)
292	*Lepadella vandenbrandei* Gillard, 1952	CA, L, P, PS, TP	N, NE, S	AFR, AUS, ORI	4, 6, 8, 10, 13, 14, 16, 18, 21, 24, 25	
293	*Paracolurella aemula* (Myers, 1934)	PS	S	NEA, NEO, ORI	17	
294	*Squatinella lamellaris* (Müller, 1786)	L, P, PS, RF	NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 6, 8, 13, 14, 18, 24, 39	Syn.: *Squatinella mutica* (Ehrenberg) (Ref.13,24), *Squatinella lamellaris* (Müller) f. *mutica* (Ehrenberg) (Ref. 4,14,18)
295	*Squatinella leydigii* (Zacharias, 1886)	PS	S	AUS, NEA, NEO, ORI, PAL	11, 16	Incl.: *Squatinella leydigii* f. *longiseta* (Ref.11,16)
	Family Lindiidae					
296	*Lindia torulosa* Dujardin, 1841	PS	S	AFR, ANT, AUS, NEA, NEO, ORI, PAL	20	
	Family Mytilinidae					

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
297	*Lophocharis salpina* (Ehrenberg, 1834)	CA, L, P, RE, RF, RI, TP	N, NE, C	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 14, 18, 21, 25, 27, 39	
298	*Mytilina acanthophora* Hauer, 1938	CA, L, P, RF	N, NE	AFR, AUS, NEO, ORI, PAL	4, 10, 14, 18	
299	*Mytilina bisulcata* (Lucks, 1912)	CA, FF, L, RF, SW, TP	N, NE, C	AFR, AUS, NEO, ORI, PAL	3, 10, 14, 18, 23, 25, 27, 39	
300	*Mytilina compressa* (Gosse, 1851)	L, P	NE, S	AFR, NEO, ORI, PAL	4, 6, 8	
301	*Mytilina crassipes* (Lucks, 1912)	RE	C	AUS, NEA, ORI, PAL	22	
302	*Mytilina michelangellii* Reid & Turner, 1988	RE	C	AFR, NEO, ORI	22	Syn.: *Mytilina ventralis* f. *diversicantha* Wulfert, 1965 (Ref.22)
303	*Mytilina mucronata* (Müller, 1773)	RE	C	AFR, AUS, NEA, NEO, ORI, PAL	22	
304	*Mytilina trigona* (Gosse, 1851)*	RF	NE	AUS, NEA, NEO, ORI, PAL	39	
305	*Mytilina unguipes* (Lucks, 1912)	CA, L, RF, SW	N, NE, C	AFR, NEO, ORI, PAL	4, 10, 14, 18, 23, 27, 39	
306	*Mytilina ventralis* (Ehrenberg, 1830)	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 10, 11, 13, 14, 18, 21, 22, 23, 24, 25, 27, 39, 40, 41	
	Family Notommatidae					
307	*Cephalodella forficula* (Ehrenberg, 1830)	L, P, PS, RF, TP	NE, C, S	AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 14, 21, 24, 25, 39	Syn.: *Cephalodella forficula forficula* (Ehrenberg, 1830) (Ref. 2)
308	*Cephalodella gibba* (Ehrenberg, 1830)	L, P, PS, RF	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	2, 4, 6, 8, 14, 16, 18, 20, 21, 24, 29, 39	
309	*Cephalodella* cf. *hyalina* Myers, 1924	PS	S	NEA, ORI, PAL	11	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
310	*Cephalodella innesi* Myers, 1924	PS, RF	C, S	NEA, ORI, PAL	11, 15, 16, 20, 24, 29	
311	*Cephalodella megalocephala* (Glascott, 1893)	PS	S	ANT, AUS, NEA, NEO, ORI, PAC, PAL	15	
312	*Cephalodella mucronata* Myers, 1924	L, PS, SW	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	13, 14, 23	
313	*Cephalodella* cf. *pachyodon* Wulfert, 1937	L	NE	ORI, PAL	4	
314	*Cephalodella plicata* Myers, 1924	PS	S	AUS, NEA, ORI, PAL	15	
315	*Cephalodella songkhlaensis* Segers & Pholpunthin, 1997	L	NE, S	ORI (Known from Thailand and Cambodia)	8, 21	
316	*Cephalodella tenuior* (Gosse, 1886)	L, PS	NE, S	ANT, AUS, NEA, ORI, PAL	14, 24	
317	*Cephalodella tenuiseta* (Burn, 1890)	RF	C	AUS, NEA, NEO, ORI, PAL	29	
318	*Cephalodella ventripes* (Dixon-Nuttall, 1901)	P	NE	AUS, NEA, NEO, ORI, PAC, PAL	4	
319	*Eosphora* cf. *thoides* Wulfert, 1935	P	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	
320	*Monommata actices* Myers, 1930	L	NE, S	AUS, NEA, NEO, ORI, PAL	6, 8, 18	
321	*Monommata dentata* Wulfert, 1940	PS	S	AUS, NEA, ORI, PAC, PAL	16, 24	
322	*Monommata grandis* Tessin, 1890	PS, RF	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	11, 13, 16, 24, 39	Incl.: *Monommata grande* Tessin, 1890 (Ref.24)
323	*Monommata longiseta* (Müller, 1786)	PS, RF	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	11, 13, 16, 39	
324	*Monommata maculata* Harring & Myers, 1930	PS	S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	13	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
325	*Notommata copeus* Ehrenberg, 1834	L, P, PS	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 14, 24	
326	*Notommata pachyura* (Gosse, 1886)	CA, L, PS, RF	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 13, 14, 18, 21	Incl.: *Notommata pachyura* f. *spinosa* (Ref.13)
327	*Notommata pseudocerberus* Beauchamp, 1908	L	S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	6, 8	
328	*Notommata pygmaea* Harring & Myers, 1922	PS	S	NEA, ORI	11	
329	*Notommata saccigera* Ehrenberg, 1830	PS	S	AFR, AUS, NEA, NEO, ORI, PAL	13, 16, 24	
330	*Taphrocampa annulosa* Gosse, 1851	PS	S	AFR, AUS, NEA, NEO, ORI, PAL	11, 24	
	Family Scaridiidae					
331	*Scaridium bostjani* Daems & Dumont, 1974	CA, L, P, PS	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 10, 24	
332	*Scaridium elegans* Segers & De Meester, 1994	L, PS, SW	NE, S	AFR, AUS, NEO, ORI	12, 13, 14	
333	*Scaridium grande* Segers, 1995	CA, L, PS	N, NE, S	AFR, ORI	10, 13, 14, 16	Incl.: *Scaridium grandis* Segers, 1995 (Ref.10,14)
334	*Scaridium longicauda* (Müller, 1786)	L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	4, 6, 8, 10, 11, 13, 14, 16, 18, 21, 23, 24, 25, 39, 40	Incl.: *Scaridium longicauda* (Ref. 40)
	Family Synchaetidae					
335	*Ploesoma hudsoni* (Imhof, 1891)	CA, L, P, RE, RI, SW	NE, C	NEA, NEO, ORI, PAL	4, 14, 18, 21, 23	
336	*Ploesoma lenticulare* Herrick, 1885	L, SW	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	14, 23	
337	*Polyarthra euryptera* Wierzejski, 1891	RE	no information	NEA, ORI, PAL	3	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
338	*Polyarthra longiremis* Carlin, 1943	P, RE	NE	AUS, NEA, NEO, ORI, PAL	4	
339	*Polyarthra major* Burckhardt, 1900	L, P, RE, RF	N, NE	AUS, NEA, NEO, ORI, PAL	4, 10	
340	*Polyarthra minor* Voigt, 1904	L, PS	S	AUS, NEA, ORI, PAL	6, 8, 11, 16	
341	*Polyarthra remata* Skorikov, 1896	L	S	AUS, NEA, NEO, ORI, PAL	6, 8	
342	*Polyarthra vulgaris* Carlin, 1943	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 5, 6, 8, 10, 11, 13, 14, 18, 21, 22, 23, 24, 25, 27, 39	Incl.: *Polyarthra* cf. *vulgaris* Carlin, 1943 (Ref.25)
343	*Synchaeta longipes* Gosse, 1887	P	NE	AFR, AUS, NEA, NEO, ORI, PAL	4	
344	*Synchaeta pectinata* Ehrenberg, 1832	CA, L, P, RE, RI	N, NE	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 18	
345	*Synchaeta stylata* Wierzejski, 1893	L, P, RE, RI	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	4, 14, 18, 21, 22	
	Family Testudinellidae					
346	*Pompholyx complanata* Gosse, 1851	CA, FF, L, P, RE, RF, RI, SW, TP	N, NE, C	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 5, 10, 18, 21, 22, 23, 25, 27, 36	
347	*Testudinella ahlstromi* Hauer, 1956	CA, L, PS, RF, TP	N, NE, S	AUS, NEA, NEO, ORI	10, 13, 14, 18, 21, 25, 39	Rare species, Syn.: *Testudinella incisa ahlstromi* (Hauer) (Ref.13)
348	*Testudinella amphora* Hauer, 1938	L, PS	NE, S	AUS, NEO, ORI	13, 14, 18, 24	
349	*Testudinella brevicaudata* Yamamoto, 1951	L, P, RF, TP	N, NE, S	AFR, ORI, PAL	4, 6, 8, 10, 14, 18, 25	
350	*Testudinella emarginula* (Stenroos, 1898)	P, PS	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 18, 24	
351	*Testudinella greeni* Koste, 1981	L, RF, TP	N, NE	AFR, AUS, NEO, ORI	10, 14, 18, 25, 39	Rare species

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
352	*Testudinella incisa* (Ternetz, 1892)*	RF	C	AFR, AUS, NEA, NEO, ORI, PAL	40	
353	*Testudinella mucronata* (Gosse, 1886)	PS	S	AFR, AUS, NEA, NEO, ORI, PAL	13	
354	*Testudinella parva* (Ternetz, 1892)	L, P, PS, RE, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 13, 14, 16, 18, 21, 22, 25	Syn.: *Testudinella insinuata* Hauer, 1938 (Ref.18); *T.* cf. *insinuata* Hauer, 1938 (Ref.14)
355	*Testudinella patina* (Hermann, 1783)	CA, FF, IT, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 5, 6, 8, 10, 11, 13, 14, 16, 18, 21, 22, 23, 24, 25, 27, 36, 39, 40, 41	Syn.: *Testudinella patina* (Hermann) f. *typica* (Ref.4) Incl.: *Testudinella patina* f. *intermedia* (Ref.4,22)
356	*Testudinella tridentata* Smirnov, 1931	CA, L, P, PS, RF, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 13, 14, 16, 18, 21, 25, 27, 41	
357	*Testudinella walkeri* Koste & Shiel, 1980	L, PS	NE, S	AUS, ORI	6, 8, 14, 18, 21	
	Family Tetrasiphonidae					
358	*Tetrasiphon hydrocora* Ehrenberg, 1840	PS	S	AFR, AUS, NEA, NEO, ORI, PAL	13	
	Family Trichocercidae					
359	*Trichocerca abilioi* Segers & Sarma, 1993	L	NE	AFR, NEO, ORI	14, 18	
360	*Trichocerca bicristata* (Gosse, 1887)	FF, L, P, RF, SW, TP	N, NE, C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 10, 14, 18, 21, 23, 25, 39	
361	*Trichocerca bidens* (Lucks, 1912)	L, PS, SW, TP	NE, C, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	4, 14, 18, 21, 23, 24, 25	
362	*Trichocerca braziliensis* (Murray, 1913)	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEO, ORI	4, 10, 11, 13, 14, 16, 18, 21, 23, 24, 25, 27	Incl.: *Trichocerca brasiliensis* (Murray, 1913) (Ref.13)
363	*Trichocerca capucina* (Wierzejski & Zacharias, 1893)	CA, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 10, 14, 18, 21, 22, 23, 24, 25, 39	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
364	*Trichocerca chattoni* (Beauchamp, 1907)	P, PS, RE, TP	NE, C, S	AFR, AUS, NEO, ORI, PAL	4, 18, 21, 22, 24, 25	
365	*Trichocerca collaris* (Rousselet, 1896)	L, PS	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	13, 14	
366	*Trichocerca cylindrica* (Imhof, 1891)	FF, IT, L, P, RE, RI, SW, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 6, 8, 14, 18, 21, 22, 23, 25	
367	*Trichocerca dixonnuttalli* (Jennings, 1903)	L, TP	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	8, 14, 25	Syn.: *Trichocerca inermis* (Linder, 1904) (Ref.14,25)
368	*Trichocerca elongata* (Gosse, 1886)	L, RE	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	4, 14, 18, 22	
369	*Trichocerca flagellata* Hauer, 1937	CA, L, P, PS, RE, SW, TP	N, NE, C, S	AFR, AUS, NEO, ORI, PAL	4, 6, 8, 10, 13, 14, 18, 23, 24, 25	
370	*Trichocerca hollaerti* De Smet, 1990	L, PS, TP	NE, S	AFR, NEO, ORI, PAC	4, 6, 8, 13, 14, 18, 24, 25	Rare species
371	*Trichocerca insignis* (Herrick, 1885)	L, P, PS, RF, TP	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 6, 8, 10, 13, 14, 18, 21, 25	
372	*Trichocerca insulana* (Hauer, 1937)	L, PS, RF, TP	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 11, 14, 21, 24, 25, 27, 29	Syn.: *Trichocerca montana* Hauer, 1956 (Ref.14)
373	*Trichocerca longiseta* (Schrank, 1802)	L, RE, TP	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	14, 18, 21, 22, 25	
374	*Trichocerca mus* Hauer, 1938	PS, SW	C, S	AUS, NEA, NEO, ORI, PAL	23, 24	
375	*Trichocerca obtusidens* (Olofsson, 1918)	L, RI	NE, S	NEA, NEO, ORI, PAC, PAL	4, 6, 8	Syn.: *Trichocerca relicta* Donner, 1950 (Ref.4,6,8)
376	*Trichocerca orca* (Murray, 1913)	L, SW	NE	AUS, ORI	14	
377	*Trichocerca porcellus* (Gosse, 1851)	L	NE	AFR, AUS, NEA, NEO, ORI, PAL	12, 14, 18	
378	*Trichocerca pusilla* (Jennings, 1903)	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	1, 3, 4, 5, 10, 11, 14, 18, 20, 21, 22, 23, 24, 25, 27, 39	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
379	*Trichocerca rosea* (Stenroos, 1898)	L	NE	AUS, NEA, NEO, ORI, PAL	14	
380	*Trichocerca rousseleti* (Voigt, 1902)	L, P, RI	NE	AFR, AUS, NEA, ORI, PAL	4	
381	*Trichocerca ruttneri* Donner, 1953	L, P, PS, RE	NE, S	AFR, AUS, NEA, NEO, ORI, PAL	4, 6, 8, 14, 24	
382	*Trichocerca scipio* (Gosse, 1886)	L, PS	NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	14, 16, 18	Syn.: *Trichocerca jenningsi* Voigt, 1957 (Ref.14,16)
383	*Trichocerca siamensis* Segers & Pholpunthin, 1997	L, PS	NE, S	NEA, NEO, ORI	8, 14, 16, 21	
384	*Trichocerca similis* (Wierzejski, 1893)	CA, IT, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 4, 5, 6, 8, 10, 11, 14, 18, 21, 22, 23, 24, 25, 39, 40, 41	
385	*Trichocerca similis grandis* Hauer, 1965	PS, RF	C, S	AFR, AUS, NEO, ORI	13, 16, 27	Syn.: *Trichocerca similis* (Weirzejski) f. *grandis* Hauer (Ref.13,16)
386	*Trichocerca simoneae* De Smet, 1990	L, TP	NE	AFR, NEO, ORI, PAC, PAL	14, 18, 25	Incl.: *Trichocerca simonei* De Smet, 1989 (Ref.14,18,25)
387	*Trichocerca stylata* (Gosse, 1851)	L, P, SW, TP	NE, C	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 14, 18, 23, 25	
388	*Trichocerca tenuidens* (Hauer, 1931)	P	NE	ORI, PAL	4	
389	*Trichocerca tenuior* (Gosse, 1886)	FF, L, PS, RF, TP	N, NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	3, 10, 14, 15, 18, 20, 21, 24, 25, 39	
390	*Trichocerca tigris* (Müller, 1786)	L, P, PS, RI	NE, S	AFR, ANT, AUS, NEA, NEO, ORI, PAC, PAL	4, 14, 21, 24	
391	*Trichocerca vernalis* (Hauer, 1936)	L	NE	AUS, NEA, ORI, PAL	14	
392	*Trichocerca voluta* (Murray, 1913)	L, PS, RE	NE, S	NEO, ORI	4, 6, 8, 13, 14, 18	Syn.: *Trichocerca tropis* Hauer, 1937 (Ref.4,6,8,13,14,18)

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
393	*Trichocerca weberi* (Jennings, 1903)	L, PS, RF	NE, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	14, 18, 21, 24, 39	
	Family Trichotriidae					
394	*Macrochaetus collinsii* (Gosse, 1867)	CA, L, P, PS, RE, RF, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	2, 4, 10, 11, 13, 14, 16, 18, 21, 23, 24, 25	Incl.: *Macrochaetus collinsi* (Gosse, 1867) (Ref. 2,4,10,13,14,16,18,21,23,24,25)
395	*Macrochaetus danneelae* Koste & Shiel, 1983	L, RF, TP	N, NE	AUS, ORI	10, 14, 18, 25, 39	Rare species, Incl.: *Macrochaetus danneeli* Koste & Shiel, 1983 (Ref.10,14,18,25)
396	*Macrochaetus longipes* Myers, 1934	CA, L, P, RF, SW, TP	N, NE, C	AFR, NEA, NEO, ORI, PAL	4, 10, 14, 18, 23, 25	
397	*Macrochaetus sericus* (Thorpe, 1893)	L, P, TP	NE, S	AFR, NEA, NEO, ORI, PAL	4, 6, 8, 14, 18, 21, 25	
398	*Macrochaetus subquadratus* Perty, 1850	L, PS, SW	NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	13, 14, 18, 23	
399	*Trichotria tetractis* (Ehrenberg, 1830)	CA, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAC, PAL	4, 6, 8, 10, 13, 14, 16, 18, 21, 22, 23, 25, 36, 39, 40, 41	
400	*Wolga spinifera* (Western, 1894)	TP	NE	AFR, AUS, NEA, NEO, ORI, PAL	12, 18, 25	
	Family Trochosphaeridae					
401	*Filinia brachiata* (Rousselet, 1901)	RE	C	AFR, AUS, NEA, ORI, PAL	3, 22	
402	*Filinia camasecla* Myers, 1938	CA, L, P, RE, RF, RI, SW, TP	N, NE, C	ORI (Known from Thailand, Cambodia and India)	4, 5, 10, 14, 18, 21, 22, 23, 25, 27, 29, 41	
403	*Filinia longiseta* (Ehrenberg, 1834)	CA, IT, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 10, 11, 18, 21, 22, 23, 24, 25, 27, 36, 40, 41	Incl.: *Filinia longiseta* var. *limnetica* (Ref.22)
404	*Filinia novaezealandiae* Shiel & Sanoamuang, 1993	L, P, PS, RE, RF, SW, TP	NE, C, S	AFR, AUS, NEA, ORI	11, 14, 18, 21, 22, 23, 25, 27, 29, 41	

	Species	Habitat	Distribution in Thailand	Biogeographical distribution	References	Remark
405	*Filinia opoliensis* (Zacharias, 1898)	CA, FF, L, P, PS, RE, RF, RI, SW, TP	N, NE, C, S	AFR, AUS, NEA, NEO, ORI, PAL	1, 3, 4, 5, 10, 11, 13, 14, 18, 21, 22, 23, 24, 25, 27, 36, 40, 41	Syn.: *Tetramastix opoliensis* Zacharias, 1898 (Ref.1)
406	*Filinia pejleri* Hutchinson, 1964	CA, L, P, RE, RF, RI	N, NE	AFR, ANT, AUS, NEO, ORI, PAL	4, 10	
407	*Filinia saltator* (Gosse, 1886)	P, RF	N, NE	AFR, NEO, ORI, PAL	4, 10, 18	
408	*Filinia terminalis* (Plate, 1886)	FF, L, RE, RF	NE, C	AFR, AUS, NEA, NEO, ORI, PAL	3, 4, 40	
409	*Trochosphaera aequatorialis* Semper, 1872	CA, FF, L, P, RE, RF, SW	N, NE, C	AUS, NEA, NEO, ORI, PAL	3, 4, 10, 18, 27, 36, 40, 41	

Habitats were categorized into 13 types based on their characteristics, following Keddy (2010). A 'canal' was defined as a waterway channel or artificial waterway that is smaller and shallower than a river. Some standing-water canals were covered with algae. A 'dam' was defined as a wall built across a river to stop its flow and collect water. A 'fish field' was defined as a fish farm pond. An 'irrigation tank' was defined as an artificial reservoir of any size, often with an earthen bund constructed across a long slope to collect and store surface water from the upstream catchment. A 'lake' was considered a large natural area (at least 80,000 m²) filled with water, apart from rivers that serve to drain the lake. A 'marsh' was defined as a wetland that is permanently wet and soft, dominated by herbaceous rather than woody plant species. A 'peat swamp' was defined as a wetland where waterlogged soil prevents dead leaves and wood from fully decomposing; over time, this creates a thick layer of acidic peat. A 'pond' was defined as a standing water body, either natural or artificial, that is smaller than a lake (less than 80,000 m²) and may be covered by vegetation. A 'reservoir' was defined as a large natural or artificial water body used as a source of water supply. A 'rice field' was defined as a flooded parcel of land used for growing rice crops. A 'river' was defined as a natural flowing watercourse that moves toward an ocean, sea, lake, or another river, usually consisting of freshwater. A 'swamp' was defined as a forested wetland that occurs near large rivers or lakes and is critically dependent on natural water level fluctuations; some swamps were covered by dense aquatic vegetation. A 'temporary pond' was defined as a shallow water body that undergoes a periodic cycle of flooding and drought.

Data analysis

Sampling effort can strongly influence species numbers; therefore, three species richness estimators—Jackknife 1, Jackknife 2, and Bootstrap—were used to estimate the expected diversity of rotifers. These estimations were performed using a species accumulation curve in EstimateS (Colwell 2013). To compare rotifer species composition across

different regions and habitat types, the Jaccard similarity index was calculated using Microsoft Excel 2016.

Identification keys

Keys to species of freshwater bdelloid rotifers in Thailand This key has been adapted from Ricci and Melone (2000).		
1	Stomach with faecal pellets, usually several teeth	2
–	Stomach without faecal pellets, usually few teeth	4
2	Ring present on the trochus, 6–10 teeth	*Otostephanos donneri*
–	Ring absent on the trochus, mostly >2 teeth	3
3	Lower lip inconspicuous, head without keel, dorsal antenna extremely long and cylindrical	*Habrotrocha ampulla*
–	Lower lip distinguished, head with keel, dorsal antenna long	*Habrotrocha angusticollis*
4	Oviparous, 4 toes, integument smooth, usually 2 teeth, eyes on the brain	*Philodina megalotrocha*
–	Viviparous	5
5	Eyes often on the rostrum, 3 toes	6
–	No eyes on the rostrum, 4 toes	13
6	Foot length longer than body length 2 times	7
–	Foot length shorter than body length	8
7	Trunk oval shape, spurs without joint	*Rotaria ovata*
–	Trunk cylindrical shape, spurs with two joints	*Rotaria neptunia*
8	Foot length 1-1/2 of body length	9
–	Foot length 1/4 of body length	11
9	Three toes unequal	*Rotaria megarostris*
–	Three toes equal	10
10	Trunk clearly separated from foot segments	*Rotaria macrura*

–	Trunk unclearly separated from foot segments	*Rotaria rotatoria*
11	Spurs short, stout and without joints	*Rotaria mento*
–	Spurs long with two joints	12
12	Spurs slender and sharp tips, trunk transparent	*Rotaria neptunoida*
–	Spurs thick and blunt tips, trunk with detritus	*Rotaria tardigrada*
13	Trunk with pointed or blunt spines	*Dissotrocha aculeata*
–	Trunk without spines or thorns	*Dissotrocha macrostyla*

Analysis

Taxonomy and species diversity

The taxonomic status of rotifers in Thailand has been revised. Meksuwan et al. (2011) proposed a new genus of sessile rotifer, *Lacinularoides*, which has morphological characteristics very similar to *Lacinularia* Schweigger, 1820, except for differences in the corona. *Lacinularia* has a heart-shaped corona, while *Lacinularoides* possesses a large pair of ventral lobes, a pair of small lobes, and three dorsal lobes. Moreover, *Ptygura noodti* (Koste, 1972) was reallocated from the genus *Floscularia* Cuvier, 1798, based on observations of living specimens. Previously, this species was known only from preserved and contracted specimens from the Amazon region (Meksuwan et al. 2011). In addition, since 2011, five species—*Collotheca orchidacea*, *Ptygura thalenoiensis*, *Limnias lenis*, *L. novemceras*, and *Rotaria megarostris*—have been described as new species.

Therefore, a total of 409 freshwater rotifer species, belonging to 68 genera and 26 families, have been recorded in 41 published studies in Thailand. Seventeen species—*Collotheca ferox*, *C. orchidacea*, *Limnias lenis*, *L. novemceras*, *Mytilina trigona*, *Otostephanos donneri*, *Philodina megalotrocha*, *Platyias leloupi*, *Rotaria macrura*, *R. megarostris*, *R. mento*, *R. neptunia*, *R. neptunoida*, *R. ovata*, *R. rotatoria*, *R. tardigrada*, and *Testudinella incisa*—have been updated from the previous record by Sa-Ardrit et al. (2013). The dominant group in the Thai rotifer fauna is Monogononta, with 395 species, while Bdelloidea comprises only 14 species. Of these, 351 species are classified as planktonic and 58 species as sessile rotifers, based on their mode of living. Given the increasing number of studies on bdelloid rotifers and the growing number of species reported from freshwater habitats in Thailand, a key to species is also provided in this study to facilitate future identification and research.

The species accumulation curve for rotifer species richness in Thailand indicated that the results of all three estimators (Jackknife 1, Jackknife 2, and Bootstrap) exceeded the

observed number of species. Overall, the sampling effort (measured by the number of published studies) estimated the potential rotifer richness in Thailand to range from 460.4 species (Bootstrap) to 507.7 species (Jackknife 1) and 538.7 species (Jackknife 2) (Fig. 1 A). The Jackknife 2 estimator provided the highest maximum value in all cases, including Monogononta (519.5 species, 38 research papers), Bdelloidea (18.9 species, 7 research papers), planktonic rotifers (444.3 species, 38 research papers), and sessile rotifers (93.5 species, 20 research papers) (Fig. 1B–E).

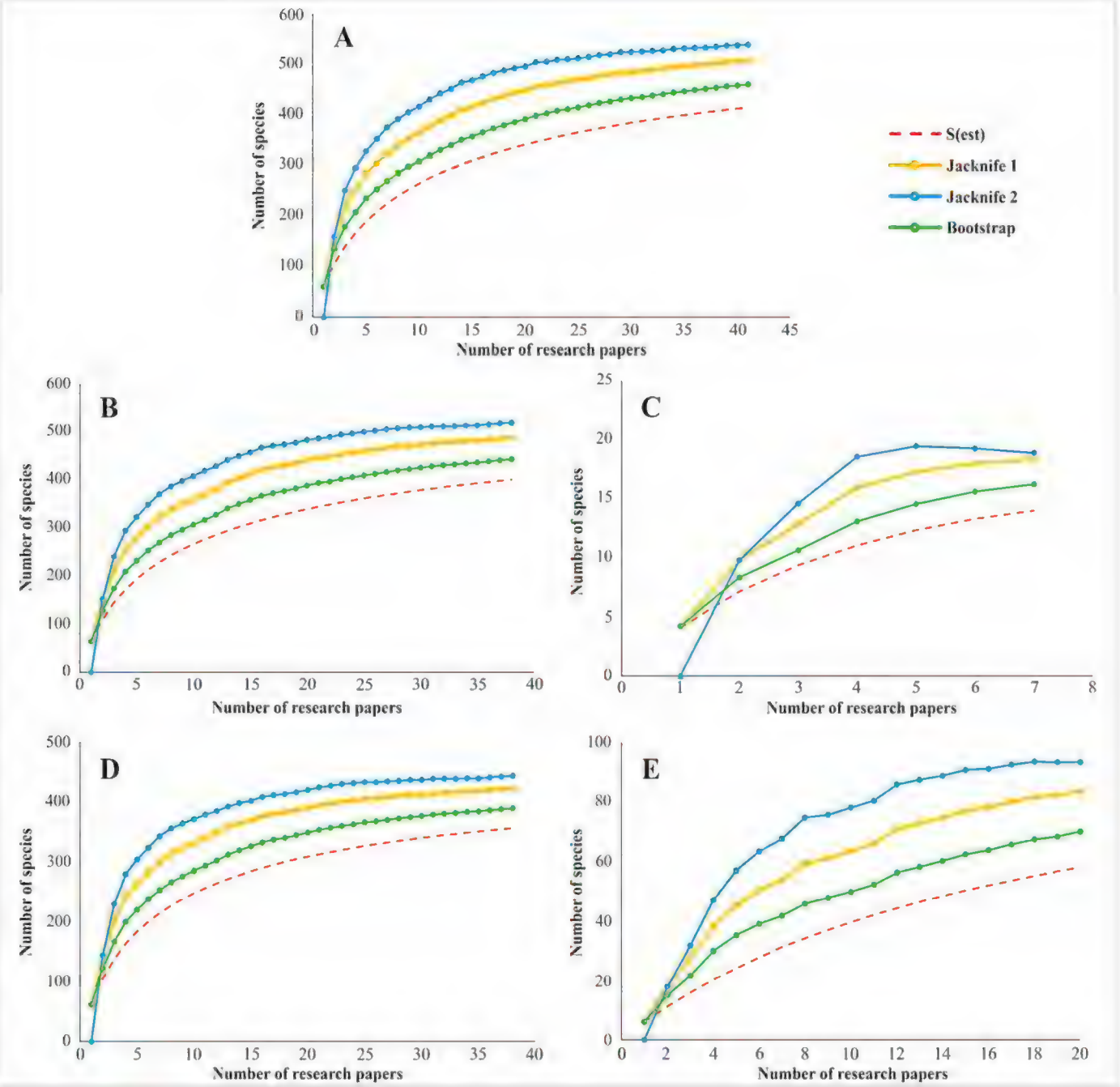

Figure 1. doi

Species accumulation curves of freshwater rotifers in Thailand. (A) Overall potential richness; (B) Monogononta; (C) Bdelloidea; (D) Planktonic rotifers; (E) Sessile rotifers.

The most diverse family was Lecanidae, with 96 recorded species (23.47%), followed by Lepadellidae (44 species, 10.76%), Brachionidae (43 species, 10.51%), Floscularíidae (38 species, 9.29%), and Trichocercidae (35 species, 8.56%). The most diverse genus was *Lecane* (96 species), followed by *Trichocerca* (35 species), *Lepadella* (30 species), and *Brachionus* (28 species).

Regional distribution in Thailand

With respect to regional distribution of rotifers across the six regions of Thailand, the northeastern region exhibited the highest rotifer richness (295 species), followed by the southern (283 species), central (202 species), northern (137 species), eastern (36 species), and western regions (10 species) (Fig. 2). Only eight species—*Brachionus calyciflorus*, *B. forficula*, *Keratella tropica*, *Rotaria megarostris*, *R. mento*, *R. neptunia*, *R. ovata*, and *R. tardigrada*—were found in all regions of Thailand, while many species were restricted to a single region. For example, *L. armata* was found only in the eastern region. Additionally, 24 species were found exclusively in the central region, 49 species in the northeastern region, and 70 species in the southern region. Notably, no rotifer species was found to be restricted to the northern and western regions (Fig. 3).

Figure 2. doi

The species richness of rotifers in each region of Thailand.

The Jaccard similarity index for species composition across different regions in Thailand ranged from 0.03 to 0.53, indicating low to intermediate similarity between regions. The northeastern and southern regions exhibited the highest similarity, with more than 50% of species shared, followed by the northeastern and central regions (48%), and the northern

and northeastern regions (45%). In contrast, the northeastern and western regions showed the lowest similarity, with only 3% of species shared (Table 3).

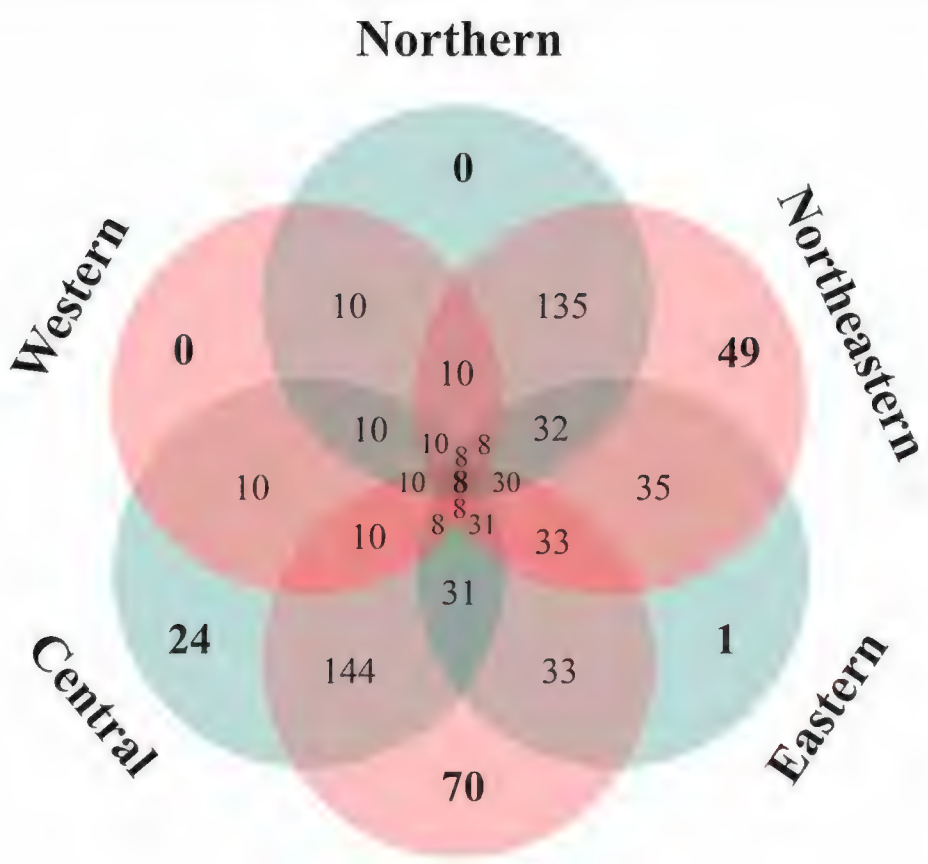

Figure 3. doi

The circle Venn diagram indicates the number of rotifers limited to each region and shared between regions in Thailand.

Table 3.

Jaccard similarity index among six regions in Thailand. Bold numbers indicated the highest value. Regional distribution abbreviations are as defined in Table 2.

Regions	NE	C	E	W	S
N	0.45	0.44	0.23	0.07	0.33
NE		0.48	0.12	0.03	**0.53**
C			0.16	0.05	0.42
E				0.21	0.12
W					0.04

Ecological distribution

Among the various freshwater habitats surveyed in Thailand, the highest rotifer species richness was recorded in lakes (286 species), followed by peat swamps (201 species),

ponds (194 species), rice fields (148 species), and swamps (133 species). In contrast, irrigation tanks exhibited the lowest richness, with only nine recorded species (Fig. 4).

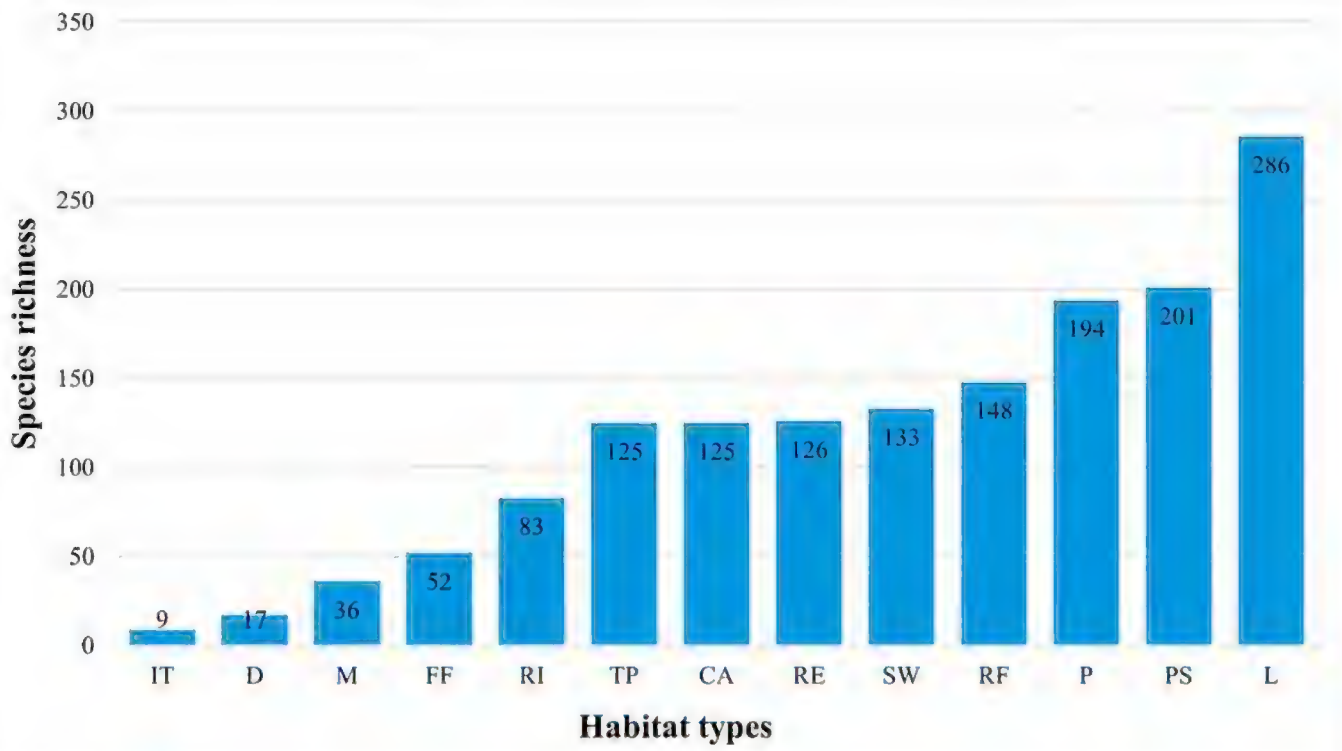

Figure 4. doi

Species richness of rotifers in across habitat types. Habitat type abbreviations are as defined in Table 2.

Additionally, the Jaccard similarity index for rotifer species composition across different habitat types ranged from 0.00 to 0.53, with most habitats sharing less than 50% similarity. The highest similarity was observed between canals and ponds, as well as rice fields and temporary ponds, with 53% of species shared, followed by canals and rice fields, with 51%. In contrast, dams and irrigation tanks showed no similarity, indicating completely distinct species compositions between these two habitats (Table 4).

A total of 32 rotifer species were recorded across a wide range of habitat types (≥10). Among these, only five species—*Brachionus calyciflorus*, *Lecane bulla*, *L. curvicornis*, *L. papuana*, and *L. quadridentata*—were present in nearly all habitat types (12). In contrast, 127 species were found in only a single habitat type. For example, *Wolga spinifera* was found only in temporary ponds. Two species—*Limnias novemceras* and *Lecane opias* were found only in rivers, whereas *Otostephanos donneri* and *Rotaria macrura* were recorded exclusively in swamps. Three species—*Cephalodella tenuiseta*, *Mytilina trigona*, and *Testudinella incisa*—were restricted to rice fields. Additionally, five species—*Brachionus leydigii*, *Dicranophorus robustus*, *Lecane lamellata*, *L. lauterborni*, and *Lepadella elliptica*—were exclusive to fish ponds. Moreover, 10, 12, 34, and 58 species were found only in ponds, reservoirs, peat swamps, and lakes, respectively. Although irrigation tanks had the lowest species richness, all species recorded in this habitat were also found in other habitat types.

Although most Thai rotifer species are widespread or cosmopolitan, several species are endemic to the Oriental region or Thailand. Of all recorded species, 28 (6.85%) were identified as Oriental endemics, while 11 species (2.69%)—*Collotheca orchidacea*, *Encentrum pornsilpi*, *Keratella taksinensis*, *Lecane junki*, *L. lungae*, *L. martensi*, *L. micrognatha*, *L. segersi*, *Limnias lenis*, *L. novemceras*, and *Rotaria megarostris*—were endemic or regionally restricted to Thailand. In contrast, 16 species were found across all eight biogeographical regions.

Table 4.

Jaccard similarity index among habitat types. Bold numbers indicate the highest similarity values. Habitat type abbreviations are as described in Table 2.

Habitat types	D	FF	IT	L	M	P	PS	RE	RF	RI	SW	TP
CA	0.13	0.20	0.06	0.38	0.25	**0.53**	0.35	0.44	0.51	0.44	0.50	0.46
D		0.10	0.00	0.06	0.33	0.08	0.07	0.12	0.09	0.12	0.11	0.11
FF			0.05	0.14	0.16	0.21	0.13	0.24	0.22	0.16	0.24	0.23
IT				0.03	0.10	0.05	0.04	0.07	0.05	0.11	0.07	0.07
L					0.12	0.48	0.43	0.35	0.40	0.26	0.39	0.40
M						0.17	0.14	0.19	0.19	0.27	0.23	0.18
P							0.39	0.47	0.50	0.36	0.50	0.50
PS								0.30	0.44	0.25	0.36	0.40
RE									0.39	0.43	0.47	0.45
RF										0.33	0.43	**0.53**
RI											0.38	0.38
SW												0.46

Discussion

Species diversity

The number of freshwater rotifer species recorded in Thailand has continued to increase due to more intensive research across diverse microhabitats. To date, approximately 409 valid rotifer species have been recorded from Thailand, representing about 20.14% of the total species within the phylum Rotifera (Segers 2008). The species richness of Thai monogonont rotifers is higher than that of other Southeast Asian countries, including Cambodia (306 species) (Sor et al. 2015), Vietnam (227 species) (Trinh-Dang et al. 2019), Malaysia (220 species) (Segers 2004), Laos (135 species) (Segers and Sanoamuang 2007), the Philippines (115 species) (Tuyor and Segers 1999), and Myanmar (100 species) (Koste and Tobias 1990). The differences in recorded species richness among these Southeast Asian countries are likely influenced more by the extent of research efforts rather than actual species diversity. Many of these countries possess a high diversity of aquatic habitats, which suggests the potential for greater species richness. If

more studies were conducted in these regions, it is likely that additional species would be discovered, further increasing the recorded diversity.

Records of freshwater bdelloid rotifers from Southeast Asia are notably scarce. In Thailand, only 14 species have been recorded, compared to 58 species reported from the Oriental region (Segers 2008). However, bdelloid species richness is higher in Malaysia (30 species) (Fontaneto and Ricci 2004) and Indonesia (30 species) (Hauer 1937, Hauer 1938, Bartoš 1963, Koste 1988) than in Thailand, whereas Myanmar (5 species) (Koste and Tobias 1990) and Vietnam (4 species) (Shirota 1966) have reported lower diversity. One of the main challenges in studying bdelloid rotifers is the need to examine key morphological characteristics while the organisms are alive. Moreover, past research in Thailand has primarily focused on the systematics of only a few genera such as *Rotaria* (Jaturapruek et al. 2018, Jaturapruek et al. 2020, Jaturapruek et al. 2021), leaving many others largely unexplored. Additionally, their ecology and evolutionary relationships remain poorly understood (Wallace et al. 2006, Segers 2008). This paper focuses on freshwater habitats; however, further research should target underexplored microhabitats, particularly limno-terrestrial environments (Donner 1965, Ricci 1987, Ricci 2001), which are closely linked to bdelloids' anhydrobiotic capabilities (Ricci 1998, Ricci and Melone 2000, Ricci 2001) and unique behavioral adaptations (Ricci and Melone 2000, Segers 2008). Although some studies have been conducted in limno-terrestrial habitats, 34 bdelloid rotifer species have so far been found in bryophytes (Jattupan et al. 2024, Pokpongmongkol et al. 2025). Addressing these knowledge gaps would provide valuable insights into the diversity and ecological roles of this fascinating group of rotifers.

The northeastern region of Thailand exhibits the highest rotifer species richness, with 295 species recorded. This region is not only the largest in the country but also the most extensively studied (Sa-Ardrit et al. 2013). Similarly, the southern region has the second-highest rotifer diversity (283 species), likely due to its wide variety of freshwater habitats and intensive research efforts. Additionally, most Ramsar sites in Thailand are located in the northeastern (Kud-Thing Lake and Khong Long Swamp) and southern (Thale-Noi Lake and To Daeng Peat Swamp) regions (Ramsar Sites Information Service 2023), contributing to the high diversity of not only rotifers but also other groups of zooplankton (Choedchim and Maiphae 2023). However, despite both regions having a high number of species, their species composition is only 53% similar. Of these, 70 species are restricted to the southern region, while 49 species are exclusive to the northeastern region. This suggests that even though they share similar types of aquatic habitats, the specific characteristics of each water body—particularly environmental factors such as temperature, pH, turbidity, trophic state (Phan et al. 2021), and dissolved oxygen (Jaturapruek et al. 2020)—as well as the level of habitat complexity (Fontaneto et al. 2006, Fontaneto et al. 2011, Kuczyńska-Kippen 2018, Jaturapruek et al. 2020) likely play a crucial role in shaping regional rotifer assemblages. Aquatic vegetation creates a more diverse environment, provides a rich food source for many zooplankton species, and serves as an effective refuge from predators (Stansfield et al. 1997, Choedchim et al. 2017).

Furthermore, while rotifer research in Thailand appears comprehensive, species richness estimators indicate that the number of existing studies is still inadequate, suggesting that many species remain undiscovered. To address this gap, further intensive research is particularly needed in the eastern and western regions, where relatively few studies have been conducted despite the presence of diverse and unique freshwater habitats. For instance, the eastern region includes coastal freshwater systems, which may be influenced by seawater during certain seasons, while the western region is characterized by numerous stream branches. Expanding studies in these underexplored areas will contribute to a more complete dataset, providing a clearer representation of the true diversity of freshwater rotifers in Thailand.

Ecological distribution

Lakes are ecologically heterogeneous environments that support the highest rotifer diversity among freshwater habitat types in Thailand. A total of 286 species have been recorded in these habitats, accounting for approximately 69.93% of the known rotifer species in Thailand. This is consistent with findings on the high diversity of other zooplankton groups, such as cladocerans, which are also predominantly distributed in this habitat type (Choedchim and Maiphae 2023). Species diversity in Kud-Thing Lake, Bueng Kan Province (Northeastern Thailand), is remarkable, with 183 recorded species (Sanoamuang and Savatenalinton 2001), followed by Thale-Noi Lake, Phatthalung Province (Southern Thailand), with at least 106 species (Segers and Pholpunthin 1997, Meksuwan et al. 2011). These two lakes are Ramsar sites in Thailand. Kud-Thing Lake is a large natural lake that receives sediment from the Mekong River, while Thale-Noi Lake is connected to Songkhla Lake (Ramsar Sites Information Service 2023). These geographical features contribute to the structural complexity of the lakes, enabling organisms to occupy various microhabitats and ecological niches. Consequently, these lakes are among the biodiversity hotspots for rotifers in Southeast Asia. In contrast, irrigation tanks exhibited the lowest rotifer species richness, likely due to the absence of habitat complexity, which restricts the diversity of ecological niches available. Additionally, short water retention times and frequent fluctuations in water levels may further impede the establishment and stability of planktonic communities in these artificial systems.

Similar habitat structures were found to result in similar rotifer compositions. Rice fields showed a high similarity in rotifer communities with temporary ponds, as both habitats undergo continuous water level fluctuations throughout the rice-growing cycle. This pattern is comparable to temporary ponds, which also experience alternating wet and dry periods. Similarly, canals and ponds—both natural or artificial standing water habitats, often covered by vegetation or algae—exhibited high similarity in rotifer composition. In contrast, certain habitat types, such as dams and irrigation tanks, have unique structural characteristics, resulting in low similarity with other habitats. However, all species recorded in these habitats were also found in other habitat types.

We highlight that, despite intensive rotifer research in Thailand, some habitats remain understudied. For instance, cave pools, which are characterized by low light levels and often low oxygen concentrations, require organisms to develop morphological and behavioral adaptations. While these habitats have been well studied for other zooplankton groups, such as copepods—where a high number of species have been recorded in these extreme environments (i.e. Watiroyram et al. 2015, Watiroyram and Brancelj 2016, Watiroyram et al. 2017, Sanoamuang and Watiroyram 2021, Watiroyram et al. 2021)—there is a lack of information on rotifers in these habitats. Although rotifers in limno-terrestrial habitats, such as mosses, lichens, and soil, have been studied in Thailand (Jattupan et al. 2024, Pokpongmongkol et al. 2025), further research is still needed.

In addition, approximately 30% of the total recorded species were restricted to a single habitat type, whereas only 1% were widely distributed across up to 12 habitat types. *Lecane bulla* and *L. papuana* are widely distributed and can be found in diverse habitats (Maiphae et al. 2023). From a zoogeographical perspective, these species are considered cosmopolitan (Segers 2007).

Moreover, *Brachionus calyciflorus* exhibits morphological adaptations in response to predation pressure and pollution. Under high predation pressure, it develops stable, long posterior lateral spines and a relatively small body size. Additionally, in polluted environments, it adapts by reducing body size and producing larger eggs (Xue et al. 2017). Due to this ability, *B. calyciflorus* occurs in nearly all habitat types (12). In contrast, some species, such as *B. leydigii*, exhibit significant habitat specialization, preferring environments with high chlorophyll a and total phosphorus concentrations (Le Coz et al. 2018), as evidenced by its exclusivity to fish fields.

Biogeographical distribution

Currently, approximately 64% of Thai rotifer fauna consists of cosmopolitan species, defined as those present in at least five of the eight biogeographical regions of the world (Segers 2008). Only 16 species are distributed across all eight biogeographical regions. However, a considerable number of species are endemic to the Oriental region (28 species) and Thailand (11 species). Due to the discovery of newly reported species and the taxonomic revision of certain rotifer groups, the number of Thai endemic species has decreased compared to the previous study by Sa-Ardrit et al. (2013). Here, we provide an updated distribution of some taxa that were previously recorded as Thai endemics. *Colurella psammophila* is now known to be restricted to southern Thailand (Segers and Chittapun 2001, Chittapun et al. 2007) and China (Wei and Xu 2014, Wei et al. 2019). *Brachionus srisumonae*, *Lecane isanensis*, and *L. niwati* are exclusively found in northeastern Thailand (Sanoamuang and Savatenalinton 2001, Segers et al. 2004, Segers and Savatenalinton 2010) and India (Sharma et al. 2017, Sharma and Sharma 2019, Sharma and Sharma 2021). *L. kunthuleensis* is known from southern Thailand (Chittapun et al. 2003, Segers and Savatenalinton 2010), China (Huang et al. 2017), and Vietnam (Duong et al. 2021). Additionally, *L. superaculeata* has been reported from

Thailand, India (Sharma et al. 2017, Sharma and Sharma 2019, Sharma and Sharma 2021), Vietnam (Duong et al. 2021), and Cambodia (Sor et al. 2015). *L. acanthinula* has extended its range beyond the traditional boundaries of the Oriental region (Segers 2001 , Sharma and Sharma 2021), now including both northeastern (Sanoamuang et al. 1995, Sanoamuang and Segers 1997) and southern Thailand (Segers and Chittapun 2001, Chittapun et al. 2007), as well as the Palearctic region, with records from Turkey (Bozkurt 2017). This extension highlights the ongoing impact of sampling effort on rotifer biodiversity—the so-called rotiferologist effect—persisting even in well-studied countries (Fontaneto et al. 2012, Jaturapruek et al. 2018, Jaturapruek et al. 2020).

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Author contributions

Conceptualization, SM.; methodology, RJ and SM; formal analysis, RJ; investigation, RJ; data curation, RJ and SM; writing—original draft preparation, RJ; writing—review and editing, SM; funding acquisition, SM. All authors have read and agreed to the published version of the manuscript.

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